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COMMUNICATIONS

OBSERVATIONS ON THE HUMAN RETINA

BY

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CAPE TOWN

DURING the last year I have had the opportunity of examining two eyes which so far as one could find were quite normal as regards the posterior segments. One was removed for an epithelioma of the limbus and had 6/18 vision, the other for a sarcoma of the orbit with 6/12 vision. Both corneae were distorted by the growth, sufficiently to account for the imperfect vision.

After hardening in Bouin's fluid the eyes were embedded in celloidin and cut, one in antero-posterior sections, the other in coronal sections. Staining was mostly by phospho-tungstic acid haematoxylin, but also by Heidenhain's haematoxylin. The former is a beautiful polychromic stain which shows up neuroglial elements well, and to a less extent nerve fibres.

Antero-posterior sections show how large a part is taken by the neuroglia in the retina. Not only does it support the different structures, but it separates them into groups, possibly units which function together.

Fig. 1, a section through the entire retina, shows the neuroglial elements well, from their beginning in the membrana limitans interna, to their other apparent termination in the membrana limitans externa. Such sections will show how the nerve fibre layer is divided into radial sheets by neuroglial elements which can be seen passing now in front, and elsewhere behind the nerve

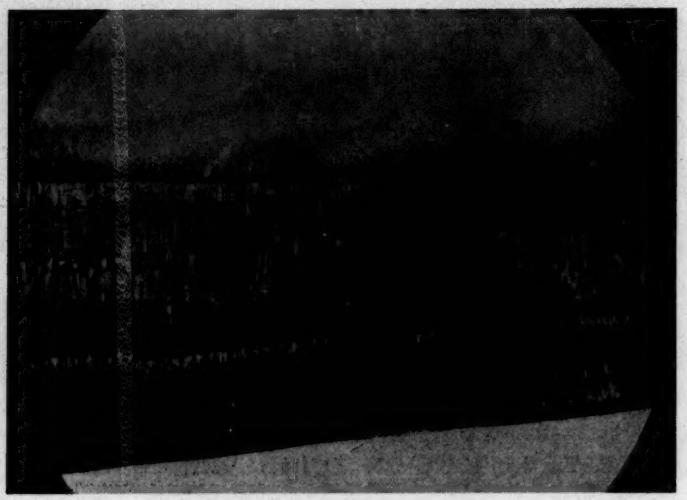

FIG. 1.

Antero-posterior section of retina under low power. The alternating layers of nerve fibres and Müller fibres are seen.

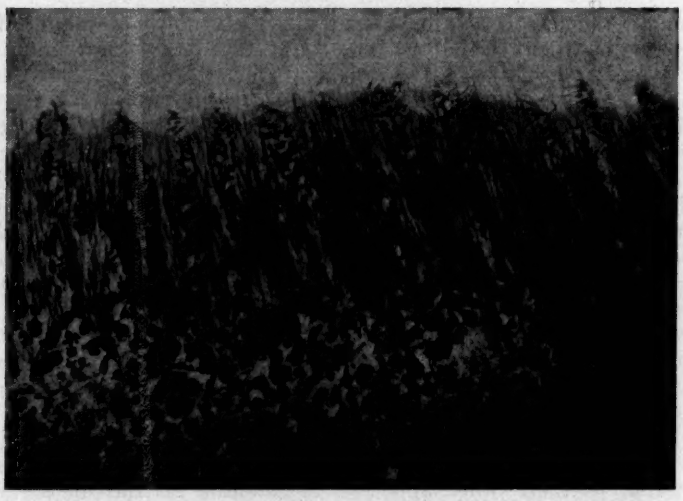

FIG. 2.

Section near edge of optic disc. The nerve fibres, shown in longitudinal bundles, are separated by neuroglial fibres cut across. The ganglion cell layer and inner molecular layer are cut on the slant.

fibres. If we examine a section cut in the opposite direction as in Fig. 2, we can see how the nerve fibres as they arise from ganglion cells are separated into bundles of very uniform size by neuroglial fibres, shown here cut across. The appearance suggests not merely an intermixture to impart strength, but also a division into, or an isolation of bundles. Antero-posterior sections at the edge of the disc (Figs. 3 and 4) show how these

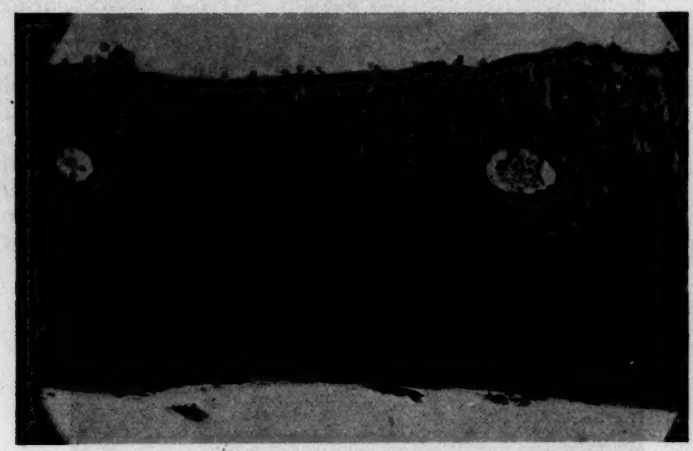

FIG. 3.

Antero-posterior section at disc margin to show the nerve fibres collected up into bundles by stout Müller fibres.

bundles are collected up into still larger units by stout Müller fibres lying between them.

One does not need to be imaginative to see that these bundles at the margin of the disc are the units which are involved in chronic glaucoma, and are implicated in the scotomata which are so characteristic of that disease. Each bundle probably does, in fact, represent a retinal area.

I have lately seen an interesting case of juvenile glaucoma where the choroidal part of the lamina cribrosa has stood up to somewhat increased tension while the scleral part has given way. The result was a ring of intact tissue with a hole in the centre through which one saw, at the bottom of a deep cup, the nerve and blood vessels. As there was no stretching of nerve fibres over the sharp edge of the membrane of Bruch, though central vision was bad, there was a full field. In the fellow eye the choroidal part of the lamina had given way also and there was a very deep ordinary cup with a field contracted almost to the fixation area.

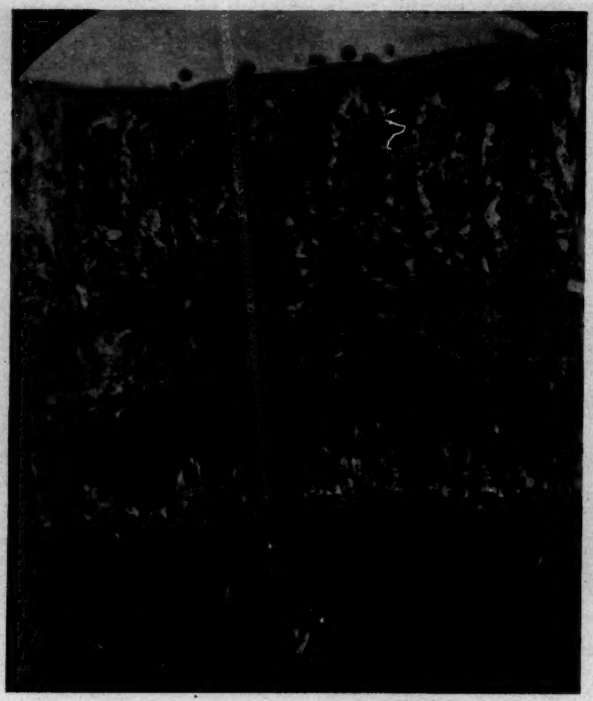

FIG. 4.

The same under a higher magnification.

The enlarged photograph gives a somewhat different appearance of the Müller fibres from that shown in some even modern text-books. Had that very careful observer, Marcus Gunn, seen it he would at once have recognized that the trumpet-shaped ends were the agents responsible for the appearance which he modestly called after the family in which he first saw it. What he called "Crick" dots, and what we now know as Gunn's dots, are almost certainly due to reflections from these trumpet-shaped ends. Gunn noticed their association with retinal sensitiveness to light. I have also seen evidence that early oedema of the retina may produce an exaggerated show of these brilliant specks of light. Some time ago I saw a patient with no visible fundus abnormality at all, who was complaining of headache and occasional sickness. Two weeks later he returned with a brilliant display of Gunn's dots, and a month

later I found him in hospital for symptoms of brain tumour with well marked papilloedema. Gunn's dots tend to become much less visible in age, possibly due to absorption of light by the lens. In young persons they can almost always be made visible by red-free light.

The nuclei of Müller's fibres usually lie in the bipolar cell layer, but often they are numerous in the external layer of dendrites, where their pyramidal shape, and dark staining make them conspicuous.

External to the layer of bipolar cells one finds a layer of closely-packed dendrites usually 7μ thick, and immediately external to this an interrupted layer which Krause called the membrana fenestrata. This, one knows, is made up of the arborisations of amacrine cells, horizontal cells, and horizontal processes of neuroglial fibres. It is not a membrane, but it has a definite structure, with segments about 10μ in length which lie in alternating rows and very regularly. Under a high power the segments show dotted markings or knobs which are probably the ends of horizontal

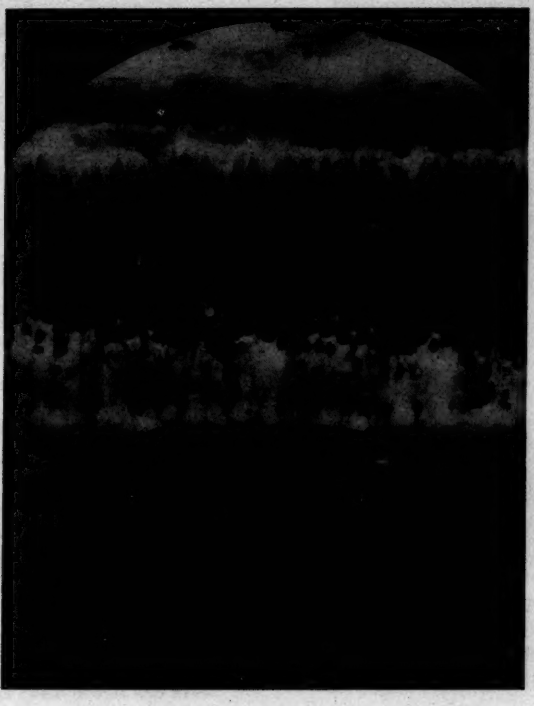

FIG. 5.

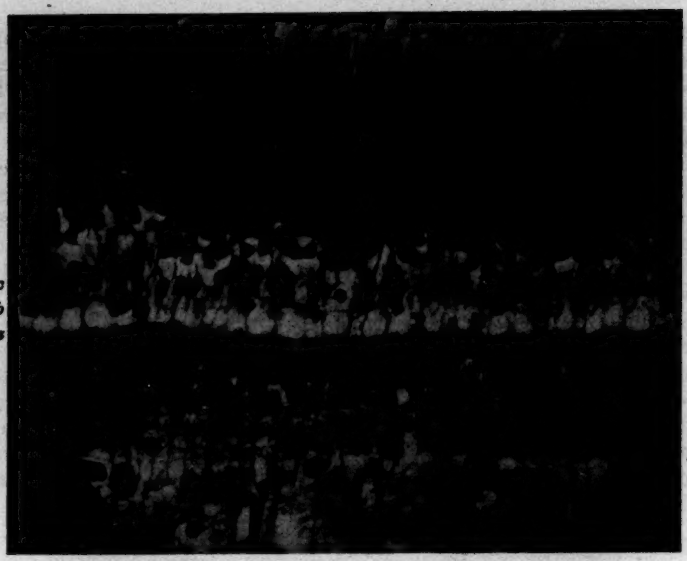

FIG. 6.

Antero-posterior sections of retina showing (*a*) the layer of dendrites external to the bipolar cells, (*b*) the segments of "Krause's membrane," (*c*) the spaces external to (*b*) bounded by neuroglial and nerve fibres. They are probably exaggerated in this specimen.

fibrils cut across. Figs. 5 and 6 show this line as it appears in ordinary retinal sections. Fig. 7 cut in a plane more or less at right angles to this indicates the arrangement of the segments, but, being nerve tissue and thin, they stain poorly. Just external to these segments we find in all retinae, spaces bounded by neuroglial and nerve fibrils. In size they vary considerably. The appearance is shown in Figs. 5 and 6. They are produced by the bowing out of fibres before they end in the segments described. I have not seen the photographs of the condition described by M. Fortin in 1925, but I think they refer to the same structures.

Passing now to the external part of the retina we come to the structure which was described by Professor Verhoef of Harvard (Fig. 8) as a new membrane in the retina.

In sagittal sections it is inconspicuous, but in coronal sections which have been bleached and stained by phospho-tungstic haematoxylin the appearance is striking.

It is not a membrane but a series of hexagonal cell walls containing the pigment cells, and though it is described as an "intercellular cement substance," that is a poor name for so beautiful a structure.

FIG. 7.

Section through (*b*) of last figure to show the segments on the flat. The section is somewhat oblique and the bipolar cells are seen below.

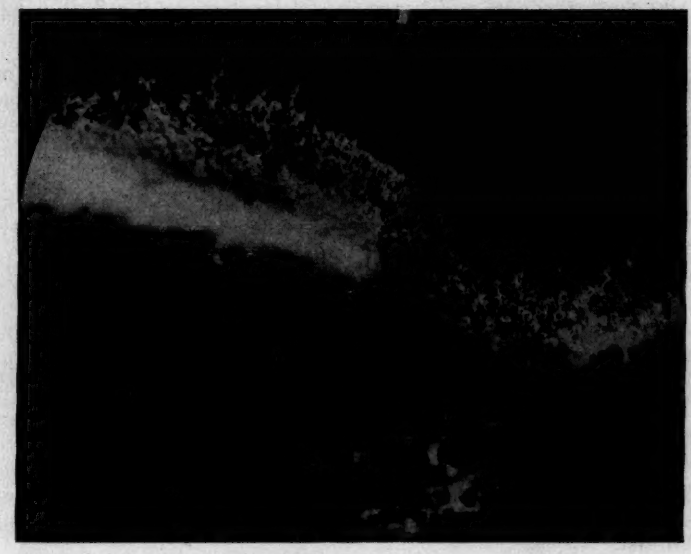

FIG. 8.

Section through hexagonal pigment cells, more or less parallel with the layer. Bleached and stained to show the "cell walls." Below is choroidal tissue, above are the terminals of the rods and cones, and higher their bodies and nuclei.

The planes which make up this honeycomb are mathematically straight, and one feels that if it were possible to get a section not on the slant the hexagons would be truly such. As it is the cell spaces are usually elongated and most are about 15μ in length. They contain a single bold round nucleus with two nucleoli, or, if the section is through the front part of the cell, the terminations of the rods and cones also. Some cell spaces contain two nuclei, and occasionally three, in which case they reach 30 or 35μ in length.

The "cell walls"—I do not know what else to call them, as there are no other structures in the body like them—stain a clear blue of the same tint as the "walls" of haemocytes which are visible in numbers cut across in the subjacent choroid. The appearance is shown in Fig. 8, but it does poor justice to the beauty of the stained specimen.

What strikes one at once is that one is looking, not at a cementing substance, but at a contrivance for isolating or insulating groups of rods and cones which function together. The terminals of the rods and cones which are embedded in the protoplasm with its acicular pigment of any one of the hexagonal cells would be subjected to similar changes in the pigment particles and in the visual purple.

Professor Verhoef believed that he could trace his membrane into the membrana limitans externa. It is difficult to corroborate this, though one must admit that the limitans externa does curl round at its end, as if to fuse with the retinal part of the membrane of Bruch. If the attractive hypothesis of Sir J. H. Parsons is correct, that the two represent the basement membrane of the primitive ependyma, the two layers have developed very differently. The openings in the membrana limitans externa are 1·5 to 2μ for the rods and about 6μ for the cones, while the honeycomb containing the pigment epithelium is from 15 to 30μ across. It may be that it would be correct to consider the prolongations of the limitans externa on to the cones and rods as analogous to the honeycomb formation to enclose the pigment epithelium.

Several ideas gather round these points. Since the rods and cones radiate out from a sphere, and become thinner at their terminal segments, they must be separated by fluid in what was once the cavity of the secondary optic vesicle. This is the reason why it is so difficult to avoid damage to the bacillary layer in cutting sections.

From the point of good vision it may be of importance that this fluid shall be unvarying in composition and tension. Hence the reason for the two layers of the membrane of Bruch, and of the associated honeycomb cells which arise probably from the

retinal layer of that membrane. They filter and damp down irregularities in the supply of fluid from the choroidal capillaries. This would seem to postulate a second membrane beyond the rods and cones to retain the fluid in the bacillary layer.

The membrana limitans externa may, therefore, serve a double purpose, to keep the rods and cones regular in their emplacement, and, by retaining fluid, to subserve regular nutrition and a normal tension.

It occurs to one as a possibility that the nutrition and in consequence the rate of metabolic change, and therefore the efficiency of response, may be to some extent related to the diameter of the cones. The long thin macular cones will get their nutritive supplies quicker and better from the surrounding fluid, than the short thick cones of the periphery. The bowing forward of the membrana limitans externa at the macula allows for this increased length.

In cases of inflammatory disease it is difficult to see traces of the hexagonal honeycomb. This would perhaps render more understandable the occurrence of metamorphopsia in central choroiditis. Insulation has broken down, and displacement has followed. A severe oedema whether on account of a retinal thrombosis, or of a choroiditis will break down all barriers. The bacillary layer of the retina can be damaged by oedema whether it comes from retinal or choroidal vessels.

Ordinary histological methods seem, therefore, to suggest that we can observe in the retina three positions where retinal elements functioning together are collected into groups. We have first the grouping of rods and cones in the cells of the hexagonal epithelium, with an arrangement to ensure equal metabolic changes in the groups.

Secondly, before the nerve fibrils enter the next neuronic chain there is a grouping, possibly to form larger units of impressions, and thirdly we have nerve fibres from retinal areas collected up into bundles before they enter the optic nerve.

I have failed to find any grouping arrangement between the bipolar cells and the next neurone, unless this is subserved by the laminated arrangement of the dendrites in the inner molecular layer.

We can, however, trace the Müller fibres at the disc margin back into the neuroglia which divides the nerve into small bundles in the anterior part of the lamina cribrosa, thence to merge into the larger bundles divided by fibrous tissue in the posterior part of the lamina and in the nerve.

We can also see how in the nerve, in longitudinal sections, the bundles divide and rearrange themselves into different bundles doubtless with reference to retinal areas, such as is well-known in the case of the macular bundle.

OCULAR DISORDERS ASSOCIATED WITH THE WISDOM TOOTH*

BY

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IT is nowadays a commonplace of ophthalmological practice that inflammatory conditions of the eye can often be traced back to septic foci in the mouth, and a dental examination is generally made. The wisdom tooth, like any other tooth, may be the site of infection, but it is my conviction that in certain cases a perfectly healthy but unerupted wisdom tooth may produce grave disturbances in the eyes which must be ascribed either to direct pressure on neighbouring nerves or to some reflex irritation. In the course of special study† of the disorders of eruption of the third molar I have collected 700 cases, half of them from the literature and half of them generously contributed by private practitioners from their case records. Among these I have 18 contributed and 32 literature cases in which there was some ocular symptom.

Among my contributed cases the majority were associated with septic infection and on these I will not lay great stress. They included cases of cyclitis, iridocyclitis and conjunctivitis associated with infected buried wisdom teeth and cured by extraction. The only point that needs emphasis in these cases is that the search for dental sepsis must never be regarded as complete unless it includes radiographic examination of the areas where wisdom teeth may be buried. There are some lamentable cases on record where this investigation was omitted and the eyes were treated for many months without benefit when the whole condition could have been cleared up in a few days had the real cause been discovered. In a case sent me by Mr. Colin Campbell of Toronto the teeth appeared perfect and had been regularly supervised since childhood, but all the same the patient had bilateral iritis with fresh precipitates and stubborn posterior synechiae. The symptoms cleared up quickly when three buried infected third molars were extracted. Brinton[1] records a case of grave uveitis treated by atropine for three weeks without benefit, but improvement within 24 hours of the extraction of a left upper wisdom tooth, the patient being practically well on the following day.

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† The preparation of my Arris and Gale (1934) and Hunterian (1935) Lectures, Royal College of Surgeons of England.

Leiche[2] reports a male of 42 who was treated by an oculist for three weeks for severe iritis accompanied by neuralgia of the left side of the face and head and the left neck and shoulder. His attack was followed by nervous breakdown, and he spent two months in the country slowly recovering. Six weeks after his return he had a second attack, which lasted a week. He was then referred to a dentist, who discovered an impacted left upper third molar by means of X-rays. He refused extraction until seven months later he had a third attack. The iritis subsided within 12 hours of the removal of the tooth; the neuralgia disappeared within a week; and two years later he had had no recurrence. One of the cases reported by Beck and Oggesen[3] a girl of 18 years of age, complained of pain in her eyeballs and lacrimation, symptoms which were attributed to eye-strain. She had infected tonsils removed with but slight relief. Later she had slight fever and rapid pulse, suggesting thyroid intoxication, and finally she had been treated for three years for phthisis. All her symptoms subsided and she regained excellent health when three impacted molars were found by X-rays and removed.

Schreiber[4] records a case of a woman of 27 years of age who had had neuralgic pain in the temple and eye for six years with intermittent blindness. Her right upper first and second molars and second premolar were removed, although they were healthy, without relief. The right lower wisdom was missing from her mouth and was revealed by X-rays impacted in the bone. More extensive films showed an inverted right upper wisdom situated high up in the back wall of the antrum. There is no mention of any infection in this case and all her symptoms cleared up when these teeth had, with some difficulty, been dealt with. A curious condition of the eye due to an impacted wisdom tooth was that reported by Benedict[5]. A woman of 22 years of age had periodic twitching and pulling of the right eyelid for 3½ years, together with a great deal of headache and face-ache. She was thoroughly examined and, nothing wrong being found, she was referred for a year. When next seen she had had two attacks of severe spasm of the right eyelid. At length a right wisdom tooth was extracted and the patient wrote: "Since I had the impacted tooth removed my eyelid has pulled but little." She had no further attacks and felt as if a weight had been removed from her life. Verrey[6] has recorded a case of unilateral mydriasis in a female of 34 years of age. She had had toothache for some months with pain radiating to the ear and neck. The eye seemed perfectly normal but its pupil was notably larger than that of the left eye; it returned to normal the day after extraction of a right lower third molar. Stucky[7] reports two case histories. In the first a female of 20 years of age had iridocyclitis and later typical fulminant

acute glaucoma. She was so bad that enucleation of the bulb seemed indicated, but, fortunately for her, X-rays were taken and revealed unerupted wisdoms on each side. She improved as soon as they were taken out. The second case was a female aged 28 years who had hypermetropic astigmatism with headache, nervousness and tachycardia. All her troubles were ended when unerupted wisdoms on each side of her mouth were removed.

Mr. A. F. MacCallan sent me notes of a case of diplopia and paresis of the right inferior rectus muscle. Three days after the extraction of her unerupted right upper and right lower third

FIG. 1.

molars her condition was normal. Dr. N. Graham Wigram sent me notes of a female aged 26 years, who had ptosis of the right upper eyelid for which no cause could be found despite careful search. Finally, an unerupted right upper wisdom tooth was found and extracted and the symptoms disappeared in a week. Another case was that sent me by Mr. J. W. Watts. The patient was a female aged 60 years, who had proptosis of the left eye with unerupted upper and left lower wisdom teeth (Fig. 1). The eye was normal a fortnight after the extraction of the left upper molar, although septic teeth were present as well and were not at that time treated. She had had the trouble in the eye for years and it had been ascribed to blockage of the lacrimal duct.

A case of Mr. A. A. Clark's, a girl aged 20 years, began to have constant pain in her eyes, making any kind of close work extremely difficult. The pain went on for four years, and then severe attacks of migraine began. Esophoria then developed and

she underwent two operations for its relief. She visited several oculists and any ophthalmic cause for her trouble was carefully excluded; nevertheless the pain continued. Then pain in the face was added to it, and some considerable stiffness of the jaw. Ultimately X-rays were taken (Fig. 2) and showed a right lower wisdom tooth just emerging from the alveolus and directed a little

FIG. 2.

forwards. The tooth in front of it was removed to make room and so relieve the pressure and there was an immediate improvement.

Roller's[8] case is perhaps the most striking of all my cases in this connection. The patient was a typist aged 35 years who developed very severe iritis of both eyes, particularly the left. The teeth were investigated and X-rays taken, but the specialist decided that they were not responsible and treated her with lotions, hot applications, dark glasses and rest for a fortnight. The pain got worse and she was given a bad prognosis. A second specialist was consulted and he also examined the X-rays and said that the teeth were not to blame. The patient then spent a month in a dark room, after which a third specialist investigated her thoroughly in the search for a toxic focus, including a review of the radiographs. He was unable to find any cause for the ocular disturbance and suggested removal of her perfectly healthy tonsils. Finally, the patient was so extremely depressed, and indeed suicidal, that

Roller's first care was to encourage her to co-operate with him and not give up hope. When the X-rays were reviewed for the fourth time, the unerupted left lower wisdom tooth was noted. More X-rays were taken and the tooth was removed after a somewhat difficult operation. It was perfectly healthy. Decided improvement was manifest in her eyes three days later, and the bandages were removed in two weeks. In four months she was back at work. The roots of the wisdom tooth were very close to, if not actually touching, the inferior dental nerve, and this case seems to show the possibility that eye conditions may be due to the reflex irritation of pressure upon local nerves in the absence of infection.

J. Jameson Evans[9] has expressed his difficulty in accepting the ordinary explanation which connects dental and ocular conditions by haematogenous sepsis. He suggests that the disorder of the tooth sets up reflexes which lower the vitality of the eye, and emphasizes the frequency with which one eye only is affected—that of the same side as the offending tooth. This ipsilaterality would be very difficult to explain on the grounds of blood-borne sepsis. In fact, he says at one point "I am inclined to think that it is possible to get chronic glaucoma set up by the irritation of an unerupted molar." Wilmer[10] is more cautious still. He classifies diseases which arise from teeth into (1) reflex neuroses, and (2) inflammatory or degenerative changes. In the first group, "the disturbance in the functions of the eye comes through the nervous apparatus from irritation of the dental branches of the trigeminus," *e.g.*, amblyopia without visible changes in the fundus; blepharospasm; paralysis of the external eye muscles; mydriasis; asthenopia, neuralgia, etc. Under the heading of inflammatory or degenerative changes, he includes pulp stones in his list of dental causes, which otherwise are all septic states.

These authors therefore advance towards, without clearly stating, the thesis of this paper, viz., that ocular conditions may be set up in some cases by reflex irritation from the teeth where no sepsis is present.

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THE TRACHOMA PROBLEM

BY

A. F. MACCALLAN, C.B.E.

THE article with the above title by Lieut.-Col. Wright in the June issue of the *Brit. Jl. of Ophthal.* requires some comment from me.

1. In 1934 I was requested to prepare a report on "Trachoma in the British Colonial Empire" for presentation at a joint meeting of the International Association for the Prevention of Blindness and the International Organization against Trachoma.

I carried out the hack work which this report entailed at the Library of the London School of Tropical Medicine, from some scores of official reports on Public Health from all parts of the Empire. I omitted references in order to make the report readable.

This report was published in French in the October, 1934 number of *La Revue Internationale du Trachome*. In it the following quotation was made:—"Dans un régiment de cavalerie en garnison dans la province de la frontière nord-ouest 97% de Sikhs . . . étaient atteints de trachome."

As Wright states, in an article in the June number of the *Brit. Jl. of Ophthal.*, this statement appearing to require elucidation, he referred it to the proper Authorities, by whom I was invited to substantiate it.

A prolonged search at the Library failed to run to earth the quotation, but I found in other official reports statements on the same lines, which were published, with full references, in the English version of my report in the *Brit. Jl. of Ophthal.* for November, 1934. For instance in the Annual Report of the Public Health Commissioner with the Government of India for 1931 (Vol. II, p. 36), and in the British War Office Report of the Health of the Army for 1931 (Vol. LXVII, p. 121), it is stated that "well over 90 per cent. of the Sikhs are infected" with trachoma. So no serious exception can be taken to the quotation in French given above, at any rate as regards the Sikhs.

Wright in his article says, "if we use the word trachoma in as loose a sense as that employed by those who primarily furnished the figures on which this international report was based, etc.", thereby suggesting that a large proportion of the cases of conjunctivitis examined in India are not trachoma at all. However that is a matter which he may discuss more usefully with the Public Health Commissioner with the Government of India, and with the Medical Department of the Indian Army concerned with recruiting. It should be mentioned that in the Annual Report of the Public Health Commissioner with the Government of India

for 1931 (Vol. II, p. 62) it is stated:—"Instructions have since been issued permitting the enlistment in all recruiting centres of the following types of cases (of trachoma), (*a*) Early cases in the papillary or follicular stage; (*b*) slightly more advanced cases, etc."

It is obvious that the above mentioned instruction to recruiting Medical Officers would have been issued only after serious consideration, and after deciding that it was not possible to obtain a sufficient number of non-trachomatous recruits.

2. Wright says, "there is also a general vagueness as to what is meant by trachoma clinically," and "what does the average ophthalmologist mean by trachoma?" However he has himself given a fairly satisfactory clinical definition in the *Brit. Jl. of Ophthal.*, June, 1935, p. 314. There is very little difference in the clinical descriptions of the disease given in the excellent books on trachoma by Morax and Petit, by Cuénod and Nataf and in an out-of-print book by MacCallan. There is a fair proportion of cases of conjunctivitis seen in trachomatous countries in which immediate clinical diagnosis is difficult or impossible. Unfortunately neither cultures nor microscopical examinations are of help in diagnosis.

3. The capillary haemorrhages which Wright mentions as being prominent to slit-lamp examination can of course be seen in any case of acute conjunctivitis in any country.

4. In a paper published in the *Trans. Ophthal. Soc. U.K.*, Vol. XXIV (1904) pp. 67 *et seq.* Lieut.-Col. Herbert made the original observation of the presence in certain cases of established trachoma of depressions at the upper margin of the cornea. These were recognized as the sites of former corneal follicles by Meyerhof (*Klin. Monatsbl. f. Augenheilk.*, Vol. 46, 1908, p. 363) by MacCallan (Trachoma and its complications in Egypt, Cambridge University Press, 1913, p. 25); and by later authors such as Bonnet (*Bull. Soc. d'Ophtal. de Paris*, December, 18, 1926); by Morax and Petit (*Le Trachome*, Paris, 1929, p. 173); by Cuénod and Nataf (*Le Trachome*, Paris, 1930, p. 73); by Pascheff (*Trans. Ophthal. Soc. U.K.*, 1933, p. 240, who gives earlier references); and by Busacca (*Brit. Jl. of Ophthal.*, January, 1935, p. 26, who gives important microscopical findings).

Apparently Herbert is not in agreement with the view that follicles are the antecedents of "Herbert's peripheral pits" (*Brit. Jl. of Ophthal.*, May, 1935, p. 261 *et seq.*).

5. When I began to see hospital out-patients in a trachomatous country I was confronted with a number of different types of trachoma all of which it was customary in Egypt and elsewhere at that time to lump together as trachoma. There was complete confusion in the minds of ophthalmologists then, as there still

is in some other countries, as to the evolution of the disease. But in 1905 I adopted a definite scheme of classification of the stages of trachoma which enabled us to appreciate the need for different modes of treatment in different stages. This classification was published first in 1912 (Report of the Ophthalmic Section of the Department of Public Health, Government Press, Cairo, p. 7), after a trial in Egypt for seven years. It is still used in all hospitals and schools in Egypt.

Before treatment it is advisable to make certain that the conjunctival change is really due to trachoma by observation of early pannus vessels with the corneal loupe or slit-lamp.

There is no doubt that in some people trachoma is a very mild disease, requiring very mild treatment, and this is more frequent in some countries, such as India, than in others, such as Egypt.

Equally with Wright I regret that there has been no marked improvement in the methods of treatment during the last 30 years.

6. Lieut.-Col. Wright says, "In view of the fact that there is such widespread interest in the problem (of the aetiology of trachoma) and that the recent literature indicates a more concentrated effort, it may not be out of place to suggest that an attempt be made to abstract the international literature and present it under the different headings of investigation in an orderly and abbreviated form available to future investigators in any of the different fields for easy reference." As President of the International Organization against Trachoma I am glad to inform him that Dr. Wilson, the Director of the Memorial Ophthalmic Laboratory in Egypt, has consented to undertake this task, as his contribution to the annual meeting of the Organization, which will take place at the time of the International Congress of Ophthalmology in December, 1937.

CONCRETIONS IN A LACRYMAL CANALICULUS CAUSED BY ACTINOMYCES*

BY

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Dr. A. Hagedoorn who observed the patient and made the diagnosis supplied the clinical data.

A COUNTRY woman, 30 years of age, suffered from epiphora and discharge for more than 2 years. A little swelling and redness was noticed at the site of the right lower canaliculus. On pressure

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a purulent secretion was observed flowing from the lower punctum. On syringing the tear sac there was no interference with the passage of fluid. Smears of the pus showed a mass of fine filaments and many leucocytes.

The bacteriological examination of the pus gave the following results. Smears stained with Gram's method showed leucocytes and masses of long irregular filaments. The thicker parts were mostly Gram-positive, the thinner ones Gram-negative. Many filaments seemed to break down into little rods. True branching was not seen with certainty. With a platinum needle little flakes of pus could be obtained from the lacrymal duct. These were cultivated on different media, namely glycerine-agar, glucose-agar, liver-agar and Saboureaud-agar. The media were incubated aerobically and anaerobically both at 24° C. and at 37° C. Most media remained sterile. Perhaps this is due to the lysozyme of the lacrymal fluid. Only within one of the glucose-agar plates incubated aerobically for 3 days did a whitish mass grow out from the border of a flake of pus imbedded in the agar. In subcultures it proved to be a pure culture of Gram-positive filaments. The strain was rather pleomorphic depending on the medium used. The filaments were varying in size, the broth cultures especially showed many short rods. Only by dark field illumination and in the hanging drop could the branches be seen with certainty. The filaments and rods had no club-shaped ends and did not grow in rays. With Gram's method the culture forms were more evenly Gram-positive than the filaments directly from the pus.

In the beginning the culture grew both aerobically and anaerobically. After a few subcultures however it grew much better anaerobically. Aerobically at the bottom of the fluid media growth occurred only, not on the surface of the plates. No growth was obtained at 24° C. On solid media the culture was of a dull white colour, it had an irregular appearance and was adherent to the medium. In glucose broth it occurred in form of bread crumb-like masses at the bottom, the fluid remaining perfectly clear. On morphological and cultural characteristics we decided that the strain belonged to the genus Actinomyces.

After the diagnosis had been made, the canaliculus was slit up. The duct contained several clumps of soft yellowish material, which did not adhere to the wall and could easily be removed. After this treatment the patient had no further complaints.

The clumps consisted of filaments but showed no rays. Again we succeeded in cultivating an actinomyces which proved to be the same as the strain formerly isolated.

In the literature there are many records of concretions in the lacrymal ducts which consisted of actinomyces, streptothrix or leptothrix.

FIG. 1.—Smear from the pus (Gram-stain) ×1,500.

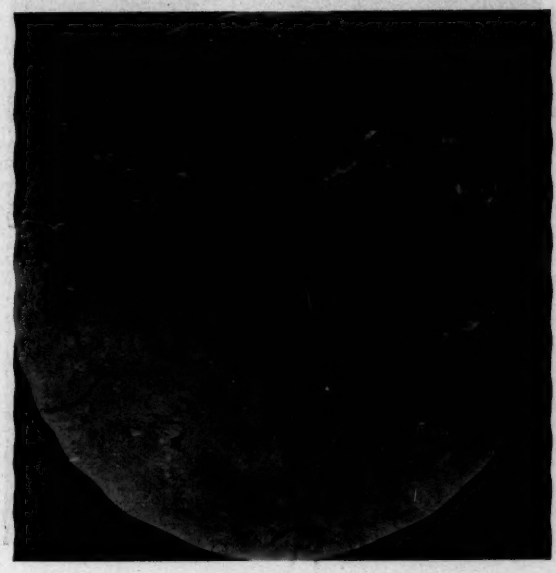

FIG. 2.—Smear from the pus (Gram-stain) ×1,500.

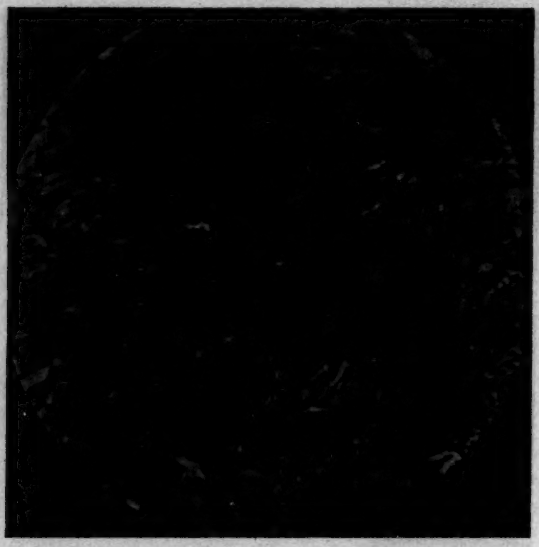

FIG. 3.—Smear from a concretion (Gram-stain) ×1,500.

FIG. 4.—Culture in glucose broth (Gram-stain) ×1,500.

James[1] describes a case with a concretion in the upper lacrymal duct caused by streptothrix. Wissmann[2] describes a pure culture of streptothrix isolated from a like concretion. Ginzburg[3] records two patients, one of whom had drusen, the other not. He thinks the first case was an actinomyces, the second a streptothrix infection. Wirtz[4] found in the lacrymal duct of a patient a chalky concretion with many filaments; however he did not obtain growth on artificial media, and considered it to be a leptothrix infection. Wanka[5] also describes a case of canaliculitis due to a leptothrix invasion, but he did not succeed in cultivating the micro-organism. A survey of the literature was given by Axenfeld,[6] and by Herrenschwand.[7]

As it is very difficult to make a diagnosis on smears without cultures it is not quite certain these were really cases of a leptothrix infection.

Following the opinion of Lieske,[8] Topley and Wilson[9] and other authors, streptothrix and actinomyces are now considered as all belonging to the same genus actinomyces. Formerly the presence or absence of drusen was considered satisfactory for ranging a strain to the genus actinomyces or to streptothrix. As however this phenomenon depends on the reaction of the host and not on peculiarities of the parasite this is not sufficient evidence for making two genera.

Thus in most instances the concretions in the lacrymal ducts described in the literature are caused by actinomyces. It is not certain whether leptothrix also plays a rôle.

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THE WATER-BINDING OF THE RETINA

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IF one lays a freshly prepared retina in a weak acid solution, the retina at once becomes opaque and thicker. If one lays a fresh retina in a strong, concentrated sugar or magnesium solution the retina immediately becomes more transparent and thinner. The retina that has become opaque and thicker gets heavier; the transparent and thinner one gets lighter. Having become more opaque and heavier in acids, the retina can again be made more transparent and lighter in solutions of sugar. Consequently the described processes are reversible.

This process of alteration of transparency, thickness and weight can be produced in many ways. It happens not only in dead eyes but also in living ones, the above mentioned capacities of the retina can be brought about in living eyes by injections of solutions which promote the water-absorption of the tissues. As far as we know no attention has as yet been paid to such processes in the retina, indeed, researches on the relations of the retina to the water-percentage of the eye are not mentioned in ophthalmological literature. Up to now the retina has been investigated pathologico-anatomically and chemically; physico-chemical and colloido-chemical investigations, however, have not yet been performed. In the following explanation we have tried to make an analysis of the physico-chemical action of the retina especially of its water-binding properties. In this we have followed the method of one of us, because this mode of working proved to be very satisfactory for the analysis of the water-binding of the cornea, sclera, lens and choroid.[1]

It was of course necessary first of all to find out and try the methods which agree with the nature of the retina, before experimental estimations could be made. If one wants to research on the water-binding of colloids one must make measurements of the *capacity*, the *intensity* and the *form* of the water-binding.

The *capacity* of the water-binding means the extent of the faculty to absorb and to hold water under certain circumstances. A measure of the capacity is the quantity of water which can be absorbed and held under these circumstances. The capacity depends on the condition of the water-percentage, the grade of dispersion, the by-mixtures, the temperature and the duration of the experiments. It is easy to keep temperature and time constant and to ascertain the water-percentage on small samples. The quantity of water absorbed can be established by weighing. The

conditions of the experiments are given by the liquids in which the retinae have been laid.

The *intensity* of the water-binding means the extent of the power to absorb and to retain water under given circumstances. A measure of the intensity is the rapidity of the absorption of water, *e.g.*, the extent of the facility with which water is absorbed. The intensity depends on the same factors as the capacity, but as to the process of the water-binding only the intensity is essential. The rapidity of the absorption and the loosening of water can again be ascertained by weighing and by the extent of the capacity with which water is held, if the retina is laid in solutions of a known capacity to attract water.

The *form* of the water-binding means the nature of the powers which promote the absorption of water. Water can be absorbed and retained as hydrate-water for instance, and certainly hydrate-water plays a great part in the large hydration-capacity of albumen.

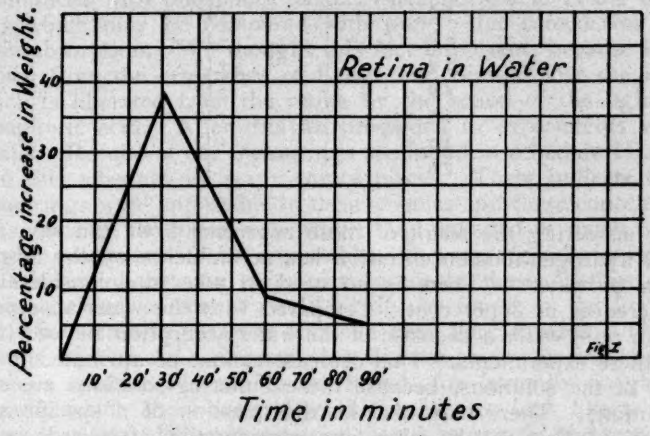
Generally it is only loosely bound and consequently easy to remove. More fixed is the capillary-bound water, which is found in the holes of colloidal dimensions. It is difficult to remove, because it obeys capillary laws. Still more firm is the absorption-water fixed by the energy-field of the surfaces. Finally water is also held by the by-mixtures which attract it osmotically. Especially significant is, however, the water which is stored in and round the parts of the substance divided into colloids which is held as colloid-bound water. It is very difficult to ascertain the form of the water-binding in detail, often it is not ascertainable. Yet we can always find out which form prevails. Further it appears from the reaction in measuring the capacity, whether the examined substance absorbs water according to the rules of swelling or in another way, which in itself allows suggestions as to the form of the water-binding. By the already mentioned researches of one of us we can compare the water-binding of the retina with that of other tissues of the eye, and consequently we are able to give a complete notion of the water-binding conditions of the eye. We hope to be able to point out that such researches are not only scientifically important, but that they are also able to explain and to reveal important clinical connections. We have gained the experience that objections are made to the effect that in researches on tissues like these on which we have experimented, it would be impossible to consider so complicated a tissue as the retina from one point of view, for instance the colloido-chemical one.

We think that the result of our experiments is the best answer to such objections. It is shown that notwithstanding its complicated structure the retina behaves indeed as substances like gelatine, consequently from the point of view of the colloid-theory

it is well defined and can be classified. We shall begin by describing our method of preparation. After this we will describe the measurement of the capacity, and then that of the intensity. Finally we shall explain the form of the water-binding of the retina and in each section we will compare the results with those of the other tissues of the eye. We have performed our studies with ox eyes obtained as fresh as possible from the slaughter house. The eyes were bisected equatorially and the vitreous body of the eye was removed by capsizing the hind half of the globe. Now the retina was exposed and was separated with a china spatula, seized by a broad pincette, and pieces, in proportion as they were wanted, were cut off. These were laid in little baskets, made of copper (messing), which were standing on a tripod in a weighing glass of a known weight. The weighing glass was closed with a lid and weighed. As the weight of the weighing-glass together with the basket and the tripod was known, the weight of the piece of the retina was made evident. The baskets were cylinder-shaped and were perforated on all sides with holes of a diameter of 0·5 mm. In preliminary researches we had ascertained that in water or in other liquids of which we intended to make use, the baskets did not change their weights within a period of two hours. When the retina had been weighed in such a basket in a weighing glass, the basket with the retina was taken out of the weighing-glass with a pincette, it was put into the testing-solution, which covered the basket and its contents, and after a definite period was taken out again in the same way, finally it was put on English blotting paper, so that the water could be removed from the basket without affecting the contents.

Any liquid that did not trickle down by itself was cautiously removed by being carefully wiped with blotting paper. After this the basket was again put into the weighing-glass and the latter was weighed. From the difference of the weight we could calculate the absorption or the loss of water in percentages. If distilled water had been used as immersion-liquid, an increase in weight could only be caused by an absorption of water. When there was a loss of weight other substances could still have been dissolved besides the water. For that reason we have taken the trouble to ascertain in preliminary researches which substances from the retina dissolve in the immersion-liquid within two hours. We found that hardly anything dissolved in the first hour, that after two hours, however, a definite loss of weight appeared. The consequence of this was, that we decided not to extend our researches over a period of more than one hour. Such simple conditions exist only when water is the immersion-liquid. From all other liquids, substances, which have been dissolved at the same time, are absorbed by the retina, but also set free again. In

proportion to the exchanged quantity of water the exchange of dissolved substances is however so small, that this circumstance cannot be considered as a source of error. We have nevertheless taken this factor into account and we have always examined the immersion-liquid after finishing our experiments. We found its composition always constant within the limits of experimental error. We have always used such quantities of the immersion-liquid that these were at least 100 times the volume of the basket filled with retina. The temperature was about the same with all experiments, namely indoor temperature varying from 60°-70° F. Before we went on with the proper measurings of the capacity of the water-binding, we ascertained the water-percentage of the



retina by drying it to its constant weight. We found a water-percentage of about 88-89 per cent. After this we ascertained the water-absorption out of pure water. In Fig. 1 it is shown that in the first 30 minutes of its stay in distilled water the retina increases its weight by 36 per cent. of its initial weight, then the increase in weight decreases again to 8 per cent. of the initial weight, measured after an hour. After 90 minutes it is only 5 per cent. more than its initial weight. It is obvious that the result of this experiment shows that the further series of experiments have to be limited to an immersion-time of half an hour, because after half an hour the increase in weight is largest. Fig. 1 is the result of numerous separate experiments and it shows average values with very small differences. As we intended to examine the water-binding in acids and alkalies, we have first examined the absorption of water in solutions of different hydrogen-ion-concentration. For this purpose we made a series of buffer-solutions with known P*h*. We used the standard-solutions of

Sörensen and the veronal buffer of Michaelis; into these solutions the retinae were brought in the way described above and after an interval of half an hour the change in weight was measured. The presence of the retina did not cause any change in the P*h* of the solutions.

The result of these tests is shown by schedule I.

SCHEDULE I.

P*h*	Increase in weight, in %
8·0	+14
7·5	+14
6·9	+13
5·9	+15
4·9	+13
4·5	+12
3·5	+13
2·6	+14

Considering the result of these experiments we can say, that this hydrogen-ion-concentration has no influence on the absorption of water. There is no need to take into consideration differences of 3 per cent. Compared with the water-absorption from pure water a decrease of the water-absorption showed itself in these experiments. This decrease cannot be attributed to the P*h* of the solutions, because these buffering-solutions are salt-solutions. There may also be the question of a specific salt-reaction. This will be taken into consideration afterwards, when we shall discuss the reaction of salt on the absorption of water. We have continued our endeavours with experiments about the water-absorption from acids. We used three mineral acids and three organic acids and each of them in the concentrations shown in schedule II.

SCHEDULE II.

	m	m/10	m/100	m/1000
Hydrochloric acid ...	−51	−13	−0	+ 15
Sulphuric acid	−36	−28	−6	+ 14
Phosphoric acid ...	−16	−0	−23	+110
Acetic acid	−36	−27	−21	− 1
Lactic acid	−30	−14	−5	+ 10
Citric acid	−17	−13	−6	+ 4

From schedule II it appears distinctly that in equinormal acids the retina absorbs quite different quantities of water. It is not to be doubted that, generally speaking, the concentration of acids is of essential significance; when the concentration decreases the water-absorption increases. In stronger concentrations we observe an extraction of water, in weaker ones even a real absorption of water. If we compare the water-absorption from pure water with that from acids, we find that both in strong as well as in weak solutions of acids the water-absorption is checked and that this checking is accordingly larger in higher concentrations of the acid. Schedule II shows, moreover, that each acid possesses its own characteristic influence on the water-absorption, which is most pronounced with phosphoric acid. Phosphoric acid is the only acid which may be compared with pure water considering its water-absorption. We thought this fact important, because it is known from the researches of Lange and Simon[2] that the acid which is liberated from the retina by the action of the light is phosphoric acid. After this we proceeded to experiments with alkalis. Results of our measurings are found in schedule III.

In this schedule are many empty places. These indicate that measurings were impossible in these alkalies and these concentrations, because the retina was swollen and changed so much, that weighing appeared to be impossible. It was especially striking that the retina became quite transparent in these alkalies and concentrations, so that it could hardly be found in the liquids and when removing it, one obtained very long threads. These threads were as clear as water, they did not show any non-homogeneous qualities as are to be found, for instance, in glass-threads, which show rosary-like thickenings or look like a fine string of pearls. When being dried they become solid and scarcely distinguishable from cobwebs. We have also examined such threads histologically, but we found nothing, they do not consist of elements of the retina, but of the alkali combined with a substance from the retina. It is also possible to produce such threads from other tissues of the eyes by putting the latter in alkalis, but the threads from the uvea are of a different nature. A short time ago one of us pointed out the clinical importance of this phenomenon.

SCHEDULE III.

	m	m/10	m/100	m/1000
Hydroxide of sodium ...	—	—	—	—
Hydroxide of potassium	—	—	+40	+32
Hydroxide of ammonium	—	+107	−45	−18
Hydroxide of calcium ...	—	—	−13	+68

It is evident from schedule III, that equinormal alkalis have a different influence on the water-absorption. Further it is shown that the more concentrated the alkali, the larger is the water-absorption; except in the hydroxide of calcium* in which the proportions are the reverse.

Compared with the water-absorption from pure water, alkalies promote water-absorption and do this in rising concentrations. They act in a way opposite to the acids.

Further it follows from schedule III that the hydroxide of sodium promotes water-absorption mostly, next are hydroxide of potassium and hydroxide of ammonium. In order to carry out a comparison between acids and alkalies of the same H-ions, respectively the same OH-ion-concentration, we have made experiments with n/50 muriatic acid, phosphoric acid, hydroxides of sodium and potassium. It appeared that in these concentrations the water-absorption was high in a quite different manner, so that we may say that the water-absorption cannot be simply dependent on the H- and OH- concentration respectively. If the water-absorption in isonormal alkalies and acids is different in comparison with that from pure water, the water-absorption can hardly be explained otherwise than by swelling-processes. This supposition becomes absolute evidence, when it can be shown that the water-absorption obeys a law in the sense of the series of Hofmeister. Hofmeister[3] has proved with gelatine plates, that in comparison with the water-absorption from pure water these plates undergo a checking in equimolar salt solutions of increasing concentrations. This checking is characteristic of each particular salt. We started from such ion-series of Hofmeister and we studied the water-absorption of the retina therein. In one tested series we varied the kations, in a second the anions. In the kation series we used chlorides, in the anion series sodium salts. We have tested the kation series in neutral, acid and alkaline reactions. To obtain acid and alkaline salt solutions of the same molarity and to retain at the same time a definite normality of the acids and alkalis we acted as follows:—30 c.cm. 2m. NaCl+30 c.cm. n/5 HCl+0 c.cm. H_2O=m. NaCl+n/10 HCl 0·60 c.cm. 6 c.cm. m NaCl+30 c.cm. n/5 HCl+18 c.cm. H_2O=10 NaCl+n/10 HCl 0·60 c.cm. By changing the molarity of the salt, when the proportion of the quantities was the same, we produced all the necessary salt solutions after this precept. In schedule IV the results of the kation experiments have been collected.

In this schedule we mean by "n" the water-absorption in percentages when the reaction is neutral, by "s" when it is an acid reaction, by "a" when it is an alkaline one. Consequently the

* Hydroxide of calcium can only be made as n/30, that is why we only used it as n/100 and n/1000.

influence of concentration and reaction can be clearly ascertained in this schedule. Magnesium and calcium-chloride precipitate when the reaction is alkaline, for that reason the water-absorption in these solutions could only be measured when the reaction was neutral or acid.

SCHEDULE IV.

	m			m/10			m/100			m/1000		
	n	s	a	n	s	a	n	s	a	n	s	a
NaCl ...	+16	-56	-26	-8	-7	-6	+9	-5	+10	+48	-2	+46
KCl ...	-36	-50	-10	-20	-21	-1	+9	-7	+15	+29	-5	+37
NH_4Cl ...	-15	-27	+6	+3	-11	+36	+5	-10	+50	+6	-3	+52
$MgCl_2$ ...	-30	-14	—	-20	-12	—	+5	-8	—	+28	-6	—
$CaCl_2$ ...	-40	-18	—	-12	-6	—	+19	+6	—	+85	+12	—

It clearly appears from schedule IV that when the concentration declines, the water-absorption rises, in comparison with the water-absorption from pure water it is checked, only in the weakest concentrations the water value is attained. An acid-reaction checks the water-absorption from salt solutions, an alkaline reaction promotes it. Equimolar solutions do not act in the same way. The results of our experiments with an anion series are shown in schedule V.

SCHEDULE V.

	m	m/10	m/100	m/1000
Na-cyanide	+76	+70	+48	+36
Na-rhodanide	+45	+32	+11	+8
Na-nitrate	+30	+22	+32	+42
Na-acetate	-8	+2	+9	+20
Na-iodide	+75	+48	+40	+19
Na-chloride	-16	-8	-9	+49
Na-bromide	+105	+53	+36	+20
Na-phosphate	+115	+48	+20	+8
Na-tartrate	+16	+22	+32	+46
Na-sulphate	+5	+12	+36	+60
Na-citrate	-13	-1	+18	+43

It is perfectly evident from schedule V, that equimolar solutions of natrium-salts exercise a quite different influence on the water-absorption. Taking cyanide, rhodanide, iodide, bromide and phosphate the water-absorption increases, when the concentration

of the salt rises, and indeed in comparison with pure water above the water value; taking nitrate, chloride, acetate, tartrate, sulphate and citrate it decreases when the concentration of the salt rises. The water value is attained in the weakest solutions. The first group promotes the water-absorption, the second checks it.

Hofmeister has already made this observation in swelling gelatine-plates and he arranged the anions in a series according to the decrease of the checking of the swelling. His series is not exactly in conformity with the one for the retina, which is not surprising, as retina represents a substance quite different from gelatine. However the same regularity is found in the retina as in gelatine. Salts exercise an influence on the absorption of water which is characteristic for each of them, and is especially manifested in the case of equimolar solutions. Thus the water-absorption of the retina shows itself as a genuine swelling. That appears also from the investigation of anelectrolytes, as is shown by schedule VI.

SCHEDULE VI.

	m/2	m/4	m/8	m/16	m/32
Saccharose	−10	+18	+19	+17	+15
Glucose	−20	+12	+14	+15	+20
Urea	+63	+50	+42	+27	+28
Glycerine	+60	+50	+45	+47	+49

As to the anelectrolytes two groups again can be distinguished, one which promotes the swelling, urea and glycerine, in which the water-absorption increases when the concentration rises, although not very evenly, and one which checks the swelling, saccharose and glucose, in which the water-absorption decreases when the concentration rises. Let us now summarise what we have established hitherto. In water the retina absorbs about 40 per cent. water in half an hour. In acids, except in phosphoric acids, the absorption of water is very strongly checked within this time, this depending on the concentration of the acids, the influence of equinormal acids is variable however. The water-absorption is promoted by alkalis, this again depends on the concentration. Equinormal alkalis too have various influences. In equally dissociated acids and alkalis the water-absorption is different, which in accordance with experiments in which the P*h* of the solutions was varied, shows that the H and OH concentration respectively is of no fundamental importance to the water-absorption. Salts generally check the water-absorption then depending on concentration. Equimolar salt-solutions again have various influences. Consequently for water-absorption a series in the sense

of Hofmeister ion-series, can be composed. Anelectrolytes influenced the water-absorption of the retina in the same way. Consequently the retina must be considered as having the property of swelling, as the described way of water-absorption cannot be brought about in another manner than by swelling-processes and so the retina must be looked upon as a gel.

The *Capacity* of the water-binding was measured by the above described experiments. It appeared that the retina is able to achieve more than 100 per cent. of its initial weight through water-absorption in the sense of swelling. A comparison with the other tissues of the eye shows that the capacity of the water-binding of the retina is somewhat greater than that of the lens, much smaller than that of the uvea, the parts of which, the iris, the ciliary body and the choroid, can increase in weight up to 500 per cent. of the initial weight in alkalis, and considerably smaller than the capacity of the walls of the eye, the cornea and the sclera, which gain in weight up to 2300 per cent. in acids. Only the last mentioned swell more strongly in acids, whilst the inner tissues of the eye swell more strongly in alkalies. We think this fact to be very important.

In order to measure the *Intensity* of the water-binding of the retina we investigated the time necessary for the swelling, the change of density in swelling, and the swiftness of the secretion of water, in the same way as we did in the cornea, the sclera, the lens and the uvea. In order to measure the swiftness of the water-absorption we laid pieces of retina, which were prepared in the way described above, in stronger concentrated solutions of anelectrolytes, of which the high osmotic capacity to attract water is well known, and after a fixed time had passed, we ascertained the changes of the initial weight. As the first testing substance we used pyridin. Schedule VII shows the result of these experiments.

SCHEDULE VII.—PYRIDIN CONCENTRATION.

Time	10%	20%	30%	40%	50%
1′	−20	−32	−22	−12	−10
5′	−4	−4	−9	+5	+8
10′	−2	−2	−8	+8	+1
30′	−10	+8	+25	+4	+0

We see from schedule VII that the secretion of water depends not only on the concentration of the solution, but more especially on the time the retina stays in the solution. Swelling processes require time, osmotic processes begin quickly and show a quick progress. Thus it can be explained that in the beginning a loss of

water arises by osmosis, which can be made up for again by the following swelling and can also be surpassed. As the osmotic capacity is well known, it gives a measure of the intensity of the water-binding of the swelling body. In schedule VIII the retina is shown as swelling in saccharose in the same way as in schedule VII.

SCHEDULE VIII.—SACCHAROSE CONCENTRATION.

Time	10%	20%	30%	40%	50%
1′	+13	+10	+10	+5	-1
5′	+5	+6	+2	-8	-15
10′	+0	+0	-8	-9	-30
30′	-5	-10	-22	-35	-48

If we compare schedule VIII with schedule VII it is evident that these processes occur more regularly in saccharose. In saccharose the influence of concentration and time shows itself very well. This is accounted for by the fact that saccharose only secretes water, whereas pyridin also shows a chemical reaction, which influences the competition between swelling and osmosis in a disturbing way.

Schedules IX and X show the importance of the nature of the swelling and also that the osmotic pressure plays an important rôle. This last fact is demonstrated by the experiments with urea and acetone. These two substances have approximately the same molecular weight whilst the molecular weight of saccharose is about four times greater than that of pyridin.

SCHEDULE IX.—CONCENTRATION OF UREA.

Time	10%	20%	30%	40%	50%
1′	-9	-25	-29	-30	-39
5′	+33	+34	+26	-13	-8
10′	+33	+26	-5	-13	-8
30′	+45	+25	-5	-9	-13

SCHEDULE X.—ACETONE-CONCENTRATION.

Time	10%	20%	30%	40%	50%
1′	+15	+9	+5	+3	+2
5′	+60	+58	+12	+13	+4
10′	+20	+11	+9	+8	+2
30′	-12	-13	-18	-18	-20

It is clearly to be seen from urea experiments that not only no swelling-processes prevail at the first, but that a not unimportant loss of water is found, which is however made up for very quickly and is followed by an even relatively large increase of water. Although a 5 per cent. urea sodium always extracts water out of the retina, even in such strong concentrations fundamentally the same things occur as in weak solutions, as in the time of action the loss of water becomes smaller and smaller. Summarizing we can say that the measuring of the swiftness of the swelling of the retina shows that the retina possesses a not unimportant intensity of water-binding. Yet it is smaller than that of the other tissues of the globe. For a second measurement of the water-binding we have taken the change of density in case of swelling. For this we acted so as to weigh the volume driven out by a piece of the retina. Therefore we used a bottle-pyknometer with a stopper ground in it and capillary tube. We have defined the volume of the pyknometer with water and quicksilver at the prevailing temperature. By doing so the weight of the dry pyknometer was also known to us. After this we first weighed the pyknometer filled with liquid, then the dry pyknometer with the piece of retina and finally the pyknometer with retina and filled with liquid. As a liquid we used xylol, which leaves the retina unchanged within the times of weighing. The specific weight can be calculated from these weighings in the following way:—

Weight of the pyknometer ... ... a_1
Weight of the pyknometer filled with liquid ... ... a_2
Weight of the dry pyknometer with retina ... ... a_3
Weight of the pyknometer with retina filled with liquid ... a_4

In this case is:

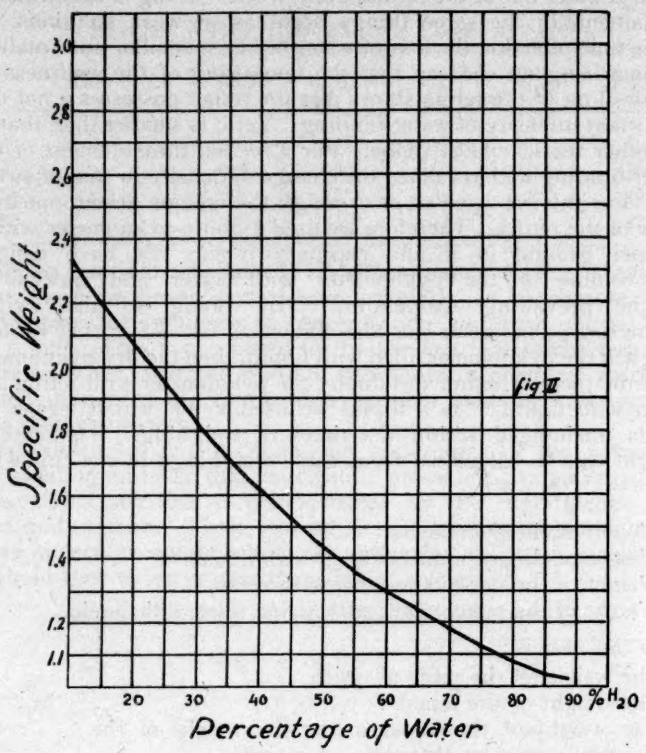
The weight of the piece of retina ... ... $a_3 - a_1$
The weight of the liquid ... ... $a_2 - a_1$
The weight of the liquid minus the weight of the liquid driven out by the piece of retina ... ... $a_4 - a_3$
The volume of the pyknometer v
From this we can calculate the specific weight of the liquid (1) ... ... $\frac{a_2 - a_1}{v}$

and the specific weight of the piece of retina (2) $\frac{(a_3 - a_1)\ (a_2 - a_1)}{v\ (a_2 - a_1 - a_4 + a_3)}$

In making these measurements, of course, great care must be taken to avoid air bubbles. However xylol penetrated very easily and the pieces of retina were chosen as large as possible. First of all we investigated retina with a normal water-percentage, after

that pieces which had suffered a definite loss of water by drying in air. The result of the measurements is shown in Fig. 2.

It is evident from this diagram that the specific weight of the retina depends on the water-percentage. A quite dry retina with a water-percentage of zero has a specific weight higher than that



of other tissue of the eye. When the water-percentage increases the specific weight decreases with great regularity. Only the lens shows a similar action. As to the outer walls of the eye the specific weight decreases by leaps and bounds when the water-percentage increases, as to tissues of the uvea we see even an increase. It is a well known fact that swelling gels undergo a contraction of volume or an enlargement of density when in swelling condition, that means that the sum of the absorbed quantity of liquid together with the volume of the dry gel is larger than that of the swollen gel. This contraction of volume is performed very evenly in the retina and in the lens. In the walls by leaps and bounds

and in the uvea there is no contraction of volume at all at a definite water-percentage, but even a dilatation. We can further conclude from this that in the case of the retina we always see the same way of water-binding. The most probable thing is that the water is always absorbed and retained intramicellarly. This is also the case with the lens as was proved by Hertel,[4] by the aid of the monochromatic Röntgen method of Debye-Scherrer. Finally we see that by swelling the retina undergoes a relative shrivelling, whereas the uvea swells relatively.

In order to measure the swiftness of the water-secretion we used in the first experimental series acetone solutions of 75 per cent. and 100 per cent. In schedule II the results have been collected. Just as in all other experimental series we measured the loss of water in percentages in these experiments and then afterwards we dried the pieces of retina up to their constant weight in order to get exactly the water-percentage of all the pieces. In this way it was possible to define how firmly and in what way water is bound. The firmness of water-binding, as well as the intensity, can be concluded from the comparison between the capacity to attract water from acetone and the nature of the binding from the fact that according to Wilstätter acetone attracts all the free and capillary-bound water and leaves only the chemically-bound and colloid-bound water behind.

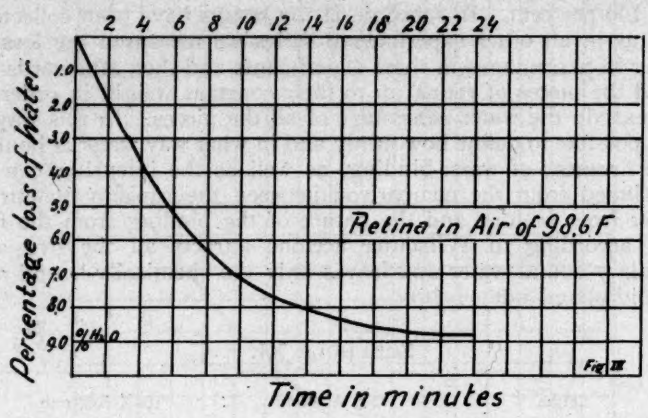
SCHEDULE XI.

Time	75% Acetone		100% Acetone	
	Water			
	Loss	Percentage	Loss	Percentage
1′	−2	88	−10	89
5′	−5	90	−54	89
10′	−16	88	−55	87
30′	−75	89	−86	89
60′	−89	89	−89	89

It is quite obvious from schedule XI that the retina looses its total water-percentage after 30 minutes in 100 per cent. acetone and after 60 minutes in 75 per cent. acetone. Thus it does not hold its water firmly and the total water-percentage is otherwise than colloido-chemically-bound. This seems to contradict the assertion that the water is intramicellarly bound. We defined

as colloid-bound water that water which is attached in and round the colloid parts. A micella is a conglomerate of such parts bound by water and in itself also water-binding. There is no doubt that such micellae define indeed the colloid-composition of the retina and consequently we are also sure of a colloid-binding of water. We rather think that the interpretation of the action of acetone is not exact. Acetone removes all "loosely-bound" water, meanwhile its action does not allow of further precision.

That will also do perfectly well for our purpose. The statement that all the water of the retina is but "loosely-bound" is sufficient



to be able to compare the nature of the water-binding with that of the other tissues of the eye. In no other tissue is all the water loosely bound. In the outer walls only 5/6 of the total water-percentage is loosely bound, in the lens about the same amount, only here the time it stays in the liquid must be about 90 times longer in order to remove the quantity of water. Finally we have still to define the swiftness of the water-secretion by measuring the exsiccation-time.

For this purpose pieces of retina which had been weighed were put into thermostats at a temperature of 98·6° F., they were lying on the perforated basket and all of them were about equally large and equally heavy, and we weighed them each hour until they had their constant weight. The result of these experiments is shown by Fig. 3.

We can see that this water-secretion too makes a very regular progress and that after 20 hours the retina has attained its constant weight. That fact shows a not unimportant intensity of the water-binding as the walls of the eye get constant after about 1½-2 hours,

the tissues of the uvea in 3-5 hours, the nucleus of the lens in 6 hours, and the periphery of the lens only in 19-20 hours. One may say that the duration of the exsiccation-time increases together with the topographical condition of the tissue. The same statement can be made for the intensity of the water-binding, making however one reservation. The measuring of the swiftness of the swelling showed that the same makes slower progress in the retina than in other tissues of the globe, and properly speaking we must conclude from this that the intensity of the water-binding is greater in these tissues. In thinking over this series of experiments, we must come to the conclusion, that the capacity of the water-binding also plays a very important part in these experiments, which excludes the sole function of the intensity. Therefore it is also necessary to make many series of experiments and employ by different methods in order to get a clear insight into this matter. This may also be of importance regarding the understanding of those processes which dominate the water-binding of the vitreous body.

From a clinical point of view we think the result of our experiments worth while for the very reason that it is now an established fact that the retina co-operates in the water-quantity of the eye, and that the alterations of the water movement also affect the retina. The retina reacts upon alterations of the water-percentage of the free water in its neighbourhood, not only in the sense of an oedema, but also by a change of its colloid-structure. Thus it may be altered by very small quantities of such water and also by secretion of water which is certainly specially important. A long time before the changes can be proved pathologically and anatomically the retina shows itself different from that under physiological conditions. We only draw special attention to detachment and glaucoma, which two groups of diseases are certainly able to change excessively the colloid-structure and the water-binding of the retina.

In connection with this we want to say just one word as to the origin of holes in the retina, for which occurrences a gel-sol conversion must now be seriously considered, the gel-structure of the retina and its change with the water-percentage have been shown.

Summary

Methods are described by which the water-binding can be defined and it is explained that water-binding, the capacity, the intensity and the nature of the water-binding must be distinguished theoretically and practically. As similar researches had already been carried out for the cornea, the sclera, the uvea and

the lens, a comparison between the retina and these tissues was possible.

The retina is a swelling gallert with a not unimportant capacity of water-binding. This capacity is much smaller than that of the cornea, sclera, or uvea and larger than that of the lens.

The retina swells in water.

In acids, except in phosphoric acid, the swelling of the retina is checked. This is more marked in concentrated acid, but the action of equinormal acids varies.

Alkalis promote swelling of the retina. This swelling is all the greater in proportion as the alkalis are more concentrated, equinormal alkalis again act variously in strength.

In equally dissociated acids and alkalis the swelling is variable. By salts the swelling of the retina is checked and more strongly in proportion as the salt-solutions are more concentrated.

The action of equimolar salt-solutions is variable.

By anelectrolyte the swelling of the retina is influenced in the same way as by salts.

The rate of swelling of the retina is less than that of any other tissue of the globe.

The change in density in swelling makes very regular progress in the retina and it proves that the retina undergoes a very regular contraction of volume in swelling. Further this is the case only in the lens. Thus the retina undergoes a relative shrivelling in swelling, whereas the uvea, especially the choroid, undergoes a relative swelling.

In the retina all the water is loosely bound, which is not the case in any other tissue of the globe.

The exsiccation-time of the retina is longer than that of all the other tissues of the globe. Regarding the tissues of the eye the exsiccation-time increases going in a direction from the outer walls to the inner parts.

The intensity of the water-binding of the retina is great, greater than its capacity, it is smaller than the intensity of the lens, and greater than that of the other tissues.

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THREE SIMPLE AIDS IN REFRACTION WORK

BY

F. W. G. SMITH, M.A., M.D., M.CH.

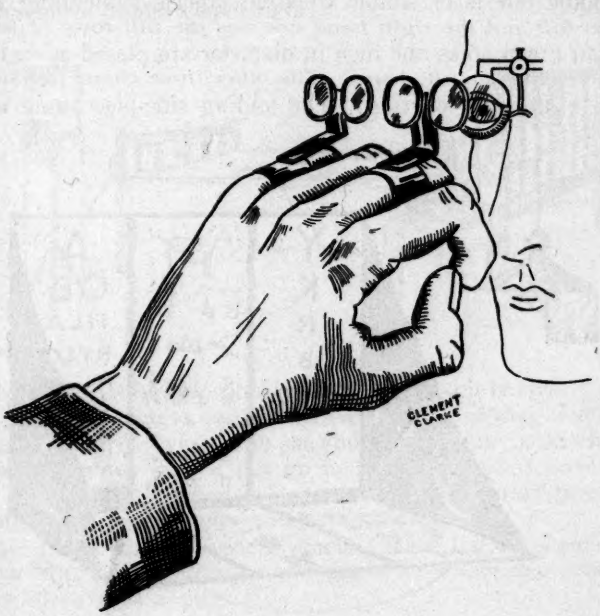
LONDON

THESE instruments have no scientific merit but my excuse for describing them is that I have found them useful in the routine examination of patients.

Finger Clip Lenses

The principle of this method is to carry on two fingers the four lenses most used in refraction cases, while being of such a size that they will not interfere with all ordinary movements of the hands.

Two spherical lenses of 2 cms. diameter and of opposite power are carried on an arm projecting from a split sleeve which is made of blackened soft metal in order that the instrument can be bent to suit the individual user. I have found that plus and minus 0·25D. and 0·50D. spheres are the most useful lenses but other powers could be obtained. The strength of the pair of lenses is



stamped on the holder and the rim of the minus lens is painted white.

The clips are slipped on to the proximal phalanges of the middle and little fingers of the left hand, or whichever the user finds more convenient, and retained on the hand until the series of patients is finished. The hands can be washed with the lenses on the fingers.

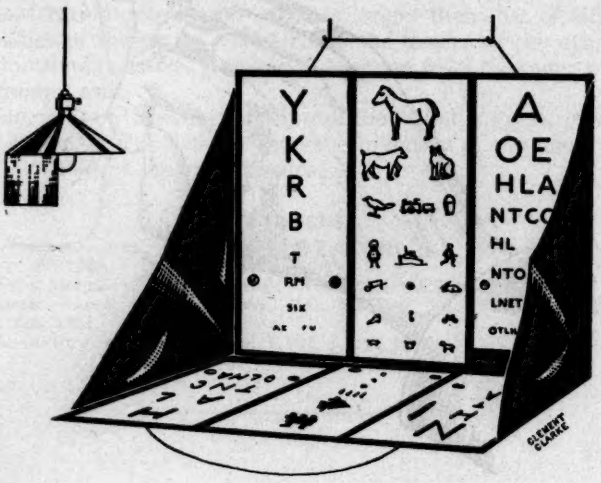
When in use the lenses are brought successively against the glass in the trial frame but the hand is usually held more obliquely and the wrist more curved than is shown in the illustration.

I have found, in cylinder retinoscopy, that the strength of the sphere and cylinder can be gauged rapidly with few changes of lenses in the trial frame and that subjectively the effect of a quick contrast makes the choice of the correct lens easier for the patient.

The labour and time expended on each refraction case is appreciably reduced, in my experience, when these lenses are employed.

Children's Distance Test

The type is made of two pieces of strong cardboard folding into 30 by 24 inches on which are six charts, three of which are visible at one time. The left chart has a Maddox single row of letters, the middle one is of simple coloured objects subtending about 6/60 to 6/9 and the right hand one has the full rows of letters. Red and green spots one inch in diameter are placed at each end of the 6/9 lines in all charts. The other three charts are similar but have different lettering. The folding side-pieces add to the



strength and aid in obscuring the lower letters from children awaiting examination. It is only necessary to invert the type to expose the other set of charts. A lamp hanging from the ceiling above the types, with the direct light shaded off the patient, gives satisfactory illumination.

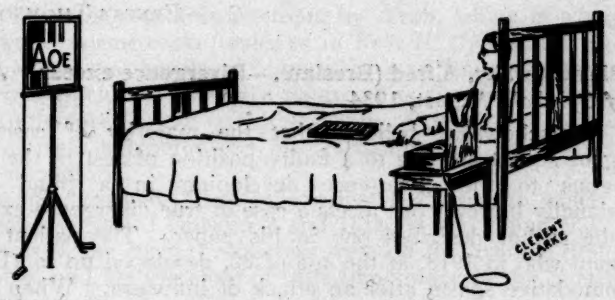
After the refraction has been done the child is asked to read the right or left chart and at the same time is tapped on the corresponding cheek. If the child appears intelligent he is asked at once to read the letters between the coloured spots. A child who is suspected of knowing the letters can be confused by switching him from one chart to the other. The coloured pictures are pointed out with a stick for those children who cannot read their letters.

I have found these types especially convenient where clinics are held in rooms which are not fitted for eye work.

The Examination of Patients confined to bed

I was led to evolve this method as I found that I could not obtain really satisfactory results by other means. Some of the apparatus is home-made and possibly unduly clumsy but all of it, with a set of trial lenses, can be carried in a suit case.

The essentials are a mirror, a folding metal music stand and a test type box somewhat similar to the Drummond Currie test case but having a Maddox spot light.



The mirror is hung on the music stand which is readily adjustable as regards height and inclination. A pair of weighted strings anchor the mirror when it is set and prevent fine oscillations.

The apparatus can be put up in five minutes. I have found that the reversed method is necessary as it is rarely possible to get the full direct distance outside a hospital ward.

I am indebted to Messrs. Clement Clarke for the sketches and for carrying out my designs as regards the finger clip lenses and the children's test-type.

ABSTRACTS

I.—OPTICS AND REFRACTION

(1) **Wirgman, C. Wynn (London).—Refractive errors in rifle shots.** *Lancet*, January 12, 1935.

(1) The writer of this letter to the Editor is a specialist in the treatment of rifle shots, for errors of refraction. At any rate, the understanding of the various points of the match rifle is largely beyond the ken of the reviewer. Wirgman points out that the relief of fatigue is a great object in view, and one can easily see that small details of the shape and the centration of the glasses ordered for shooting count for a very great deal in this respect. The following statement is very interesting. "Among the open range men (*i.e.*, among those treated by the author) were five previous winners of the Queen's or King's Prize. Two of these, incidentally, had an amblyopic eye." Unfortunately, the author does not enlarge on the significance of having only one eye for shooting. The mere fact of two out of five winners of the premier award having only one eye, or at least being amblyopic in one eye, leaving the other free for concentration on the work of focusing, seems to call for remark.

ERNEST THOMSON.

(2) **Bielschowsky, Alfred (Breslau).—Divergence excess.** *Arch. of Ophthal.*, August, 1934.

(2) **Bielschowsky** believes that the majority of cases of divergent squint are due to a faulty position of rest of the eye, analogous to the divergence developing in a blind eye. Occasionally however one meets a case of true divergence excess, and the author describes one in his paper. The patient was a woman who in 1918, at the age of 22, developed up to 7D. of accommodative spasm after an attack of influenza. When seen by the author in 1922, her abduction power was 14° prism base in before both eyes and her spasm of accommodation was due to the convergence impulse which had been necessary to overcome the exophoria. Advancement of both external recti cured the exophoria and relieved the spasm of accommodation. Three years later the attacks returned, but were prevented by the use of abducting prisms of 2° before each eye. When these were not used, accommodative spasms returned combined with a convergent strabismus which gradually increased to 20°. Later the amount of prism had to be increased. In 1932 the patient was found to have

1·5D. of hypermetropia. The prolonged occlusion test gave an exophoria of only 1°, though the range of divergence was 14° for distance and 10° for near, with a normal near point of convergence. Bielschowsky therefore feels justified in stating that the abnormal divergence was due to excessive irritability of the divergence centre. There is a fundamental difference between exophoria and divergence excess, the latter being of nervous origin and having nothing to do with the position of rest. It is also characterized by its instability, the spasms of divergence being a form of functional neurosis. Psychological treatment is sometimes of value but in the present case was valueless. The following technique will show the amount of divergence excess:—Determine the strongest prism (base in) which the patient is able to overcome, and replace it by a dark red glass at the moment when diplopia appears. A crossed diplopia will result which soon diminishes. The amount of diminution indicates the active divergence power, while the remaining stationary deviation shows the amount of exophoria.

F. A. W-N.

(3) **Tron, E. (Leningrad).—On the optical factors in aniso- and isometropia. (Ein Beitrag zur frage der optischen Grundlagen der Aniso- und Isometropie).** *Arch. f. Ophthal.*, Vol. CXXXIII, p. 211.

(3) This study of anisometropia by Tron, which is a sequel to his work on ametropia (reviewed in *Brit. Jl. Ophthal.*, Vol. 18, p. 659) shows that besides differences in axial length between the two eyes (which was formerly regarded as the sole underlying factor) differences in the refractive power of the cornea, lens and entire dioptric apparatus can also contribute to the production of this condition.

From measurements taken in a series of 22 eyes, in which the anisometropia varied between 2 and 13D., it was found that the differences in the corneal refraction were on the average (0·45D.) negligible, and are therefore of little importance in the causation of anisometropia.

The refractive power of the lens, on the other hand, showed much greater differences (on the average, 2·25D.) in the two eyes, and hence is claimed to be a much more important factor, although it has no close relation to the degree of anisometropia.

The differences in the refraction of the entire dioptric apparatus (average, 1·84D.), which are almost exclusively due to those in the lens, were found to play an important part as well as those in the axial lengths (average, 2·42 mm.).

On the basis of the differences in these two factors, the refractive power of the two eyes and the axial lengths, where one or other

may be the same or both different, Tron would classify cases of anisometropia into 3 groups:—(1) Refraction anisometropia, which in his series was the least common; (2) axial; (3) of mixed origin, the latter two being of almost equal frequency.

In the mixed group these two factors seldom operated in the same direction; in most cases they tended partly to neutralize each other.

The axial and mixed forms occur in low, as well as high, degrees of anisometropia. There is no definite relation between the degree and the character of the anisometropia.

The importance of the axial factor has, in Tron's opinion, in the past been overestimated, and emphasizes the part played by the lens in cases of anisometropia due to differences in refraction of the eyes.

In isometropia the optical structure may be the same in the two eyes, while in some cases there is a difference between the individual optical elements. The number of cases examined, however, is yet too small to determine the frequency with which these factors occur.

THOMAS SNOWBALL.

II.—SCLERA

(1) **Beigelman, M. N. (Los Angeles).—Acquired cysts of the sclera.** *Arch. of Ophthal.*, August, 1934.

(1) The literature since 1853 contains accounts of only 20 epithelial cysts of the sclera and **Beigelman** therefore feels it is justifiable to describe three cases he has had under his care. The first was found in a phthisical eye, the subject of a penetrating injury 15 years previously. The cyst was a large one, greyish-white and translucent with the conjunctiva freely moveable over it. It was lined by flattened epithelial cells, arranged in from two to four layers, and at the corneo-scleral margin there was an incarceration of uveal tissue. In the second case, the cyst was smaller with no history obtainable as to its origin. The wall consisted of scleral lamellae lined by epithelial cells. The third case was interesting in that the swelling had first been diagnosed as a pinguecula, the lining was again epithelial. Scleral cysts take time to develop and are not usually noticed until some months after the injury which has caused them. Their subsequent progress is variable, some not growing to a size of more than 2·3 mm., others becoming as large as a bean or a cob nut. Owing to their traumatic origin they are always to be found in the anterior segment of the eye, often at the limbus and they tend to be common in the young because of the greater distensibility of the sclera.

The commonest method of formation is for some mechanical obstacle (prolapsed uveal tissue, incarcerated lens capsule) to prevent rapid healing of a scleral wound and so allow the downgrowth of epithelial cells. Other cysts may be formed by the traumatic implantation of epithelial cells into the deeper layers of the sclera. Treatment is simple. If the eye is hopelessly blind it should be removed with its attached cyst. If the eye has sight, removal of the anterior wall of the cyst is all that is required.

F. A. W-N.

(2) **Pillat, A. (Vienna).—A characteristic senile degeneration of the sclera at the insertion of the recti muscles. (Ueber eine eigenartige senile Entartung der Lederhaut an den Ansatzstellen der geraden Augenmuskeln).** *Zeitschr. f. Augenheilk.*, Vol. LXXXII, p. 113, 1933.

(2) Pillat draws attention to a band-shaped dirty-greyish discoloration occurring in old people at the site of the insertion of the recti muscles, most marked with the horizontal muscles. This is caused by a thinning of the sclera, due to senile changes inducing a reduction of the water content of the tissue, making it more transparent; the increase in transparency can be demonstrated by transillumination. This change must be distinguished from fatty degeneration of the sclera. It is not actually confined to the site of insertion of the recti, but is more apparent here; an increase of translucency is present in the whole of the sclerotic of the senile eye. The colour of the band-shaped degeneration is not caused by any changes in the sclerotic itself but by the underlying uvea showing through.

ARNOLD SORSBY.

(3) **Menestrina. (Milan).—A case of spontaneous intercalary staphyloma. (Stafiloma intercalare spontaneo).** *Lett. Oftal.*, January, 1934.

(3) In **Minestrina's** case a small dark excrescence had been observed above the cornea of the right eye of a boy 13 years of age. This had been diagnosed by another practitioner as a malignant growth. The media were transparent and nothing abnormal could be seen inside the eye. The author came to the conclusion that it was not a solid growth but a staphyloma. A part of the stretched sclero-corneal tissue was excised with the underlying and adherent iris; the edges were sutured and a large conjunctival flap brought over the whole. The wound healed and the patient recovered 0·3 of normal vision. The author assumes that there had been a preceding scleritis which had thinned and weakened the sclera and allowed the protrusion, but there seems to have been no direct evidence of this.

HAROLD GRIMSDALE.

III.—CATARACT AND GLAUCOMA

(1) **Strampelli (Rome).—Examination of cataractous lenses by polarised light. (Biomicroscopia ed istologia della cataratta a luce polarizzata).** *Boll. d'Ocul.*, January, 1935.

(1) In this long and copiously illustrated paper **Strampelli** records the results of the examination of a number of cases of cataract of various kinds and in various stages.

In many cases there are seen by polarized light, masses of anisotropic substance scattered through the lens, which are doubly refracting and invisible, or nearly so, to the usual methods of examination. All other opacities in the lens which are not anisotropic, are less visible by polarized light than usual. As to the nature of this substance, the author thinks that it is probably a derivative of cholesterin. In some cases the author has observed a second doubly refracting substance in the form of crystals which were not visible during life, but appeared after the extracted lens was examined microscopically, the sections being mounted in glycerine. These crystals are specially common in aged patients and seem to consist of lime salts.

HAROLD GRIMSDALE.

(2) **Rubino (Catania).—Cataract and tetany. (Cataratta e spasmofilia).** *Boll. d'Ocul.*, January, 1935.

(2) Tetany, or a state resembling it, can be produced by a number of means, of which the typical is removal of the parathyroids. In this case, changes in the lens are a very common sequel; according to some, constant if the parathyroids have been completely removed. As to the cause of this association, there is difference of opinion; some have held the cataract to be due to some toxic substance which is normally destroyed by the parathyroids, others to spasm of the ciliary muscle. It is known that guanidin which can give rise to tetany is present in abnormal quantity in the blood and excreta in tetany. **Rubino** has tried to clear up the question of the toxic action of guanidin and its derivities by producing guanidin poisoning in rabbits. He has in some cases kept these animals alive for many weeks but has in no case observed any change in the transparency of their lenses. He concludes that guanidin is not by itself able to cause all the signs of tetany, but that there must be some change in the electrolytic equilibrium, especially of the calcium salts. To this is due the lens change.

HAROLD GRIMSDALE.

(3) **Vecchi (Padua). — Is cataract in man due to bacteria? (Ricerche sperimentali sulla questione della etiologia batterica della cataratta umana).** *Ann. di Ottal.*, February, 1935.

(3) Lavagna has suggested that cataract was due to the action of bacteria and claims to have been able to produce cataract in guinea pigs by inoculating them with a piece of cataract from man. **Vecchi** has in this paper reported the results of experiments undertaken to test Lavagna's theory.

He has endeavoured to cultivate bacteria from cataracts and also to produce cataract in animals by injecting in various situations emulsion of human cataractous material. All his results have been negative. He therefore does not believe in Lavagna's theory.

HAROLD GRIMSDALE.

(4) **Sanguinetti. (Ravenna).—Glaucoma and cataract. (Glaucoma e cataratta).** *Lett. Oftal.*, November, 1934.

(4) Since glaucoma and cataract are both common diseases of advancing years, it is not surprising that they occur together at times in the same subject. The surgeon is called upon in such a case to decide what is the best form of treatment to adopt; there are two main conditions in which he must make decision:— (1) When the cataract is mature and there is also chronic glaucoma, and (2) where there is chronic glaucoma and early opacities of the lens which may become complete later.

There can be no doubt that in the first case extraction with iridectomy is indicated; if afterwards the tension is found not to be relieved, a sclerectomy of some kind must be performed. The decision is harder, when an eye which has undergone sclerectomy for glaucoma, develops cataract.

If the sclerectomy has been successful in reducing tension permanently, the incision for the removal of the cataract, when this becomes necessary, should not involve the existing scar; if the incision is placed in the cornea, the advantage of a conjunctival flap is necessarily lost. The author suggests that, to retain this aid, two conical flaps of conjunctiva should be dissected up, having their bases at the limbus, at the points of entry and exit of the Graefe's knife in its passage across the anterior chamber. The median part of the incision is made within the corneal limbus. When the lens has been extracted, the flaps are replaced and assist in the rapid healing of the corneal wound.

HAROLD GRIMSDALE.

(5) **Tronosco, M. U. and Reese, A. B. (New York).—Gonioscopic findings after Elliot operation.** *Amer. Jl. of Ophthal.*, February, 1935.

(5) **Tronosco and Reese's** paper contains some interesting observations made with the gonioscope on 29 glaucomatous eyes

which had been trephined. Incarceration of a ciliary process or several ciliary processes was seen in 41·3 per cent., iris incarceration in 24·1 per cent., incarceration of ciliary body and iris in 3·4 per cent., exudations in the angle with attachments to the ciliary body or sclera or both in 20·6 per cent., marked post-operative iritis with posterior synechiae in 24·1 per cent. and normal healing in 10·3 per cent. only.

The authors comment that in cases where the peripheral synechia is broad the trephine passes through the adherent iris root and enters the posterior chamber in a number of cases. In these there is a greater risk that ciliary processes will be drawn forwards and become adherent or incarcerated in the wound. In cases where the peripheral synechia is narrow the trephine enters the anterior chamber and a small fragment of iris root is left.

This paper contains several interesting microphotographs of sections through corneo-scleral trephine holes which demonstrate such complications as ciliary body and iris incarceration and forward displacement of the lens.

H. B. STALLARD.

(6) **Rycroft, B. W. (London). — Hunterian Lecture.** Royal College of Surgeons, England. February, 1935.

(6) **Rycroft** in discussing the aetiology of glaucoma mentioned a number of interesting facts that have arisen from recent researches on the physiology of intra-ocular pressure, vitreous turgescence, and the presence of a histamine-like substance in the aqueous humour in cases of acute glaucoma.

Friedenwald is quoted for his opinion that aqueous is formed by the iris and that most of its absorption is through this structure.

The author expresses the view that the filtration angle and canal of Schlemm are unessential for mechanical filtration of aqueous and that aqueous leaves the eye by absorption into the veins which exert an osmotic pressure of 30 mm. Hg from the plasma they contain and have a venous capillary pressure of 22 mm. Hg.

He states that the vitreous in life is incapable of expanding sufficiently to cause occlusion of the filtration angle by forward displacement of the ciliary body and iris root and quotes Cohen's recent work to show that normal vitreous does not swell.

The author describes the part played by the extra-ocular muscles and blood volumes in the maintenance of intra-ocular pressure. He believes that the fall of intra-ocular pressure on dividing an extra-ocular muscle is due to severing some of the blood vessels supplying the uveal tract.

He discussed the part played by a histamine-like substance in producing vaso-dilatation but whether this is brought about by an axon reflex or is of central origin is at present unknown. The

author has found a vaso-dilator substance allied to histamine in the aqueous of 6 cases of acute glaucoma.

The epidemic glaucoma described by Maynard in India is due to a diminution of osmotic pressure leading to an increase of fluid in the vitreous, oedema of the skin and lungs, and diarrhoea. It is thought that this type of glaucoma is produced by toxins containing histamine-like bodies leading to vaso-dilatation. The experimental work of Mendel and Peters in rats fed on a low protein diet have verified the fact that osmotic pressure is diminished under these conditions.

The author showed drum tracings of experimental work done on the intra-ocular pressure to demonstrate the effects of exsanguination, ligature of the carotid artery and the jugular veins, the injection of normal saline and hypertonic saline into the blood stream, injections and instillations of histamine and adrenalin. Clinical conditions associated with glaucoma were enumerated and the medical and surgical treatment described. Except for the mention of diathermy no therapeutic measures other than those which have now been long established and practised were described.

H. B. STALLARD.

IV.—CONJUNCTIVA

(1) **Balbuena, Dr. F. (South America).—Three cases of septicaemia following pneumococcal conjunctivitis. (Tres casos de septicaemia consecutivos a conjunctivitis neumococica.** *Arch. de Oftal Hisp.-Amer.*, Vol. X, p. 169, 1935.

(1) **Balbuena** records 3 cases of pneumococcal septicaemia occurring two or three days after the onset of pneumococcal conjunctivitis.

The first case was a woman 30 years of age. There was an intense oedema of the lids, with much pus, some corneal oedema, much chemosis and some spots of haemorrhage; there was also an oedema of the face extending to the lips, the nose and the ears, the preauricular glands were swollen and painful; the pus contained pneumococci.

The case was treated with silver nitrate, and three days later presented alarming symptoms, the oedema had spread to the neck and chest, the patient was feverish and ill and was obliged to remain in bed; a blood culture shewed the presence of pneumococci.

For some days following, the patient was feverish, delirious and extremely prostrated, she was treated with intravenous injections of anti-pneumococcal serum and recovered.

The other two cases were both children between 1 and 2 years of age; in both cases there was a marked conjunctival secretion, chemosis and some spots of haemorrhage; there was much oedema of the face and neck.

The blood culture shewed the presence of pneumococci, and after the symptoms of a typical septicaemia both these cases died.

The author remarks upon the difference in susceptibility seen during epidemics of pneumococcal conjunctivitis, and suggests that in these cases the infection was spread by the lymphatics to the blood, the spread occurring about 24 hours after the conjunctival symptoms had begun.

E. E. CASS.

(2) **Fodor, G. (Budapest).—Organisms in the normal and inflamed conjunctiva. (Ueber die Bakterienflora der Bindehautentzündungen bzw. der normalen Bindehaut, und deren Bewerlung).** *Klin. Monatsbl. f. Augenheilk.*, Vol. XCII, p. 643, 1934.

(2) From an analysis of 104 cases in which pneumococci and streptococci were present in the conjunctiva, **Fodor** concludes that pneumococcus (type IV) may be found in almost any condition ranging from normal conjunctiva to panophthalmitis. Only such cases of conjunctivitis as run the characteristic course with critical healing should be regarded as of pneumococcal origin; pneumococci of type I and II are generally responsible for this affection. Since most ocular complications due to pneumococci are caused by organisms of type IV, sero-therapy has no basis in ophthalmology.

ARNOLD SORSBY.

(3) **Stewart, F. H. (Egypt).—Further researches as to the cause of trachoma.** Eighth Annual Report of the Giza Memorial Ophthalmic Laboratory. 1933. Government Publications Office, Cairo. Price, 25 piastres.

(3) In his introduction to the matter of **Stewart's** paper, the Director of the Laboratory, Wilson, says, "Of all the various theories which have been advanced to explain the origin of trachoma, and of all the various bacterial agents which have from time to time been held responsible for this disease, none have so tardily resisted critical investigation as the Halberstaedter-Prowaczek Korperchen (H. P. K.). When however similar bodies were discovered in a number of other diseases, doubt arose as to their causal relationship to trachoma, but recently, seeing that bacterium granulosis has failed to establish its claims, there has been a definite swing back to the study of H. P. K. The author working in this Laboratory, has advanced evidence to show that these bodies are formed by the phagocytosis of bacteria which

are not the cause of trachoma. Whether they may carry the virus of trachoma (as he considers possible) is another matter and still lacks experimental evidence. In this report we append two more papers by the author both in further support of the bacterial origin of H. P. K., the latter dealing more particularly with the transmissibility of H. P. K.

There are those who firmly believe that the inclusions are aggregations of virus, while on the other hand there are those who are equally positive that trachoma is not caused by an ultramicroscopic virus.

As far back as 1905 Pfeiffer and Kuhnt made repeated unsuccessful attempts to induce trachoma in human subjects with filtrates from emulsions of trachomatous tissues and Hess and Roemer (1910) confirmed these experiments, but in 1913 Nicolle, Cuénod and Blaizot claimed that they had obtained positive results from inoculation of chimpanzees and baboons with similar filtrates. More recently, 1933, Baroni and Mikhail have reported positive results with trachoma virus kept in 50 per cent. glycerol at 6 degrees centigrade for 24 hours, so that the evidence as it stands is very conflicting."

The correct name for the inclusion bodies in the epithelial cells is the Halberstaedter-Prowaczek Körperchen, abbreviated to H. P. K., and has been thus amended in the above quotation.

The author considers that H. P. K. are not associated with pure trachoma but with trachoma complicated by bacterial infection of the conjunctiva or face.

"H. P. K., or the elementary granules of which they are composed, will not grow on any artificial medium. They cannot therefore be isolated in pure culture, and we have to fall back on crude experiments in which secretion containing H. P. K. is transferred to a second conjunctiva. We can of course never be sure that H. P. K. are the only bodies transferred or that it consists of only one organism."

The trachoma patients in Java, with whom Halberstaedter and Prowaczek had to do in 1907 and 1909, had such a high degree of bacterial infection of the conjunctiva as to render them useless for direct microscopical examination.

Men inoculated from undoubted trachoma complicated by bacterial infection may develop trachomatous lesions. They also show H. P. K. in a large proportion of cases. Men inoculated from doubtful sources, who have developed chronic conjunctivitis without typical signs of trachoma, also have H. P. K., although in lower proportion.

In monkeys inoculated from trachoma, complicated by bacterial infection, H. P. K. have been recorded when the animals showed no sign of trachoma. H. P. K. are frequently absent when the monkey has the clinical signs of trachoma.

The author concludes that H. P. K. represent phagocytic vacuoles in epithelial cells. They may contain any micro-organism which is present in the conjunctiva, either bacterial or granular. In Egyptian trachoma H. P. K. appear only with secondary bacterial infection. In uncomplicated Egyptian trachoma, and in experimental trachoma of monkeys, H. P. K. are absent during all stages. He has not found free initial bodies or free elementary bodies in Egyptian trachoma.

The author finds that trachoma virus can survive three or four hours at room temperature in Egypt in saline solution or bouillon, and it can survive repeated grinding and centrifuging. *Filtrates through gradocol membranes or through Berkefeld V candles are not infective,* although the former may contain enormous numbers of granules which closely resemble the elementary bodies of H. P. K.

In centrifuge experiments the virus is not removed from the deposit even by repeated washing, in fact washed trachoma tissue appears more soluble than unwashed. The disease is therefore not due to a soluble agent. This is confirmed by the non-pathogenic character of the filtrate.

Infection of monkeys with trachoma. Material for inoculation is taken from active trachoma (Tr. I, Tr. II *a* or *b*, or Tr. III). Between 20 and 30 days after inoculation the conjunctiva of the fornix is found to be covered with follicles, small clear blister-like projections, about 1 mm. in diameter. They extend down to the upper edge of the fornix but no further. The surface of the conjunctiva may be congested or not. There is no discharge and the animal gives no sign of feeling the condition. A case is reckoned to be positive only if follicles appear about the 20th to the 30th day and cover the whole conjunctiva of the upper fornix.

As Nicolle and Lumbroso have pointed out an animal may be a carrier of a spontaneous folliculosis which may develop actively if irritated. All animals should therefore be tested by non-trachomatous inoculation before being used for trachoma studies, and no single experiment should be accepted as proof.

A. F. MACCALLAN.

(4) **Fede (Gela).—Vaccine therapy in trachoma. (Sulla vaccino-terapia del tracoma).** *Lett. Oftal.*, November, 1934.

(4) The opinion has lately gained ground that the evil results of trachoma are due not so much to that disease, as to intercurrent infections of pathogenic micro-organisms. Many authorities hold that uncomplicated trachoma is a mild and rapidly regressing disease. It is certain that many cases, in countries where trachoma is endemic, go on to a spontaneous cure without treatment; it is

certain also, that the chief cause of blindness in Egypt and Palestine is not trachoma but a superadded purulent conjunctivitis.

Hence the attempt has been made to limit the evil effects of trachoma by a polyvalent vaccine against the most common intercurrent infections. Such a vaccine has been put on the market under the name of *Lacmin*, and **Fede** claims to have had great success with it. It may be administered in subconjunctival injection, by painting the conjunctiva (this is the most useful method) as drops, or as ointment. It is important, further, says the author, to treat the general diathesis which is at the root of trachoma, which is not a parasitic infection, by such measures as are suitable.

HAROLD GRIMSDALE.

(5) **Olitsky, Syverton and Tyler (New York).—Studies on the etiology of spontaneous folliculosis of rabbits: I. Transmission and filtration experiments: II. Bacteriological investigations.** *Jl. of Exper. Med.*, July-September, 1934.

(5) The above mentioned research was carried out at the Laboratories of the Rockefeller Institute for Medical Research. In previous articles in the same journal **Olitsky, Syverton and Tyler** described spontaneous conjunctival folliculosis as it occurs in Macacus rhesus monkeys and in chimpanzees. This was transmissible from animal to animal and a new organism which was designated as Bacterium simiae was shown to have an intimate relationship to the infection.

They have found that a spontaneous folliculosis of the conjunctiva is widely distributed among various species of rabbits. This is transmissible from rabbit to rabbit. The cornea is never affected. The causal agent is not filtrable. No inclusion bodies can be found to be associated with the disease. Therefore the authors conclude that an ultra-microscopic virus is not the cause of the disease, which is characterized by a persistent chronicity.

Among the bacteria isolated from folliculosis tissue a new species, was isolated which, when injected into the conjunctiva of rabbits, produced a condition indistinguishable from the disease seen in nature, and from the experimentally produced disease the identical micro-organism has been recovered.

A distinctive feature of this bacterium is that it is of the same genus as Bacterium simiae, above mentioned, and Bacterium granulosis, the organism described by Noguchi as the causative agent of human trachoma.

The pious Olitsky, pupil of Noguchi, proposes to rename the Bacterium simiae as Noguchia simiae, the Bacterium granulosis as Noguchia granulosis, and the rabbit organism as Noguchia cuniculi, (n. sp.).

A. F. MACCALLAN.

V.—RETINA

(1) **Lindner, Dr. K. (Vienna).—The modern treatment of detached retina. (Ueber die derzeitige Behandlung der Netzhautabhebung).** *Wein. Klin. Wochenschr.*, February, 1935.

(1) After recounting the new views as to the causation of retinal detachment, **Lindner** proceeds to describe the methods employed by him in dealing with this condition. In the first place he emphasizes the need for preventing the eyeball making any rapid movements. For this purpose he uses opaque spectacles with only a central aperture and maintains that this procedure prevents the detachment becoming more extensive, and, after operation, from recurring at other places.

As regards operative procedures, in most cases he employs the diathermy current. In flat detachments the method described by Weve by which needles are introduced through the sclera all around the hole and adhesive inflammation caused. The many punctures made by this method are generally sufficient to drain off the subretinal fluid, making a definite opening for this purpose unnecessary.

For the more extensive and balloon detachments the Safar method is used by which the whole area is surrounded by multiple shallow punctures and finally the subretinal space opened to drain off the fluid.

For detachments at the posterior pole to which access cannot be obtained, or only with difficulty, he uses a modification of the method advocated by Guist which he calls the undermining method. The sclera is incised down to the choroid, as far back as possible, and then a blunt spatula, or repositor is cautiously introduced between the sclera and choroid and pushed forward to the region of the retinal hole. Then 1/100 c.c. of a 3 per cent. caustic potash solution is injected into the space thus made and several highly successful results have thus been obtained.

(2) **Koyanagi, Y. (Sendai).—On the secretory activity of the retinal pigment epithelium in exudative retinitis (Coats). [Ueber die sekretorische Tätigkeit des retinalen Pigmentepithels bei Retinitis exudativa (Coats)].** *Arch. f. Ophthal.*, Vol. CXXXIII, p. 173.

(2) **Koyanagi** here discusses the part played by the retinal epithelium in the production of the "effusion" found between choroid and retina in exudative retinitis.

He examined microscopically two cases, in the first of which the pigment epithelium could be seen in its natural position clearly in the process of secreting a highly albuminous substance,

which at first in small amount in the basal portion of the cell increases so as almost to fill the cell-body and is then extruded. In the protoplasm of the epithelium are often seen numerous fine threads which are taken to be the primary stage of the fluid secretion.

The choroid takes no part in the production of the subretinal mass, while the fact that the spaces in the outer layers of the retina contain a substance similar to that in the subretinal fluid is no proof that the latter is derived from the retina.

In the second case the retinal epithelium layer was stripped extensively and partly replaced by regenerating cells; these desquamated epithelial cells, however, are capable of considerable proliferation and assuming a secretory function, a claim that is supported by the fact that the subretinal fluid in the immediate vicinity of the desquamated epithelium is markedly richer in albumin.

The presence of cholesterin might indicate that it is essentially a serofibrinous exudate from the diseased retinal vessels, but there is no proof of this, and it is claimed that cholesterin is a product of secretion from the retinal epithelium.

The author is inclined to think that the so-called ghost cells (Coats) are for the most part nothing else than the desquamated epithelium cells that have not yet undergone degeneration, their secretory activity being characterized by the marked increase in albumin always present in the coagulated fluid immediately surrounding them.

He holds that this primary effusion of fluid by the pigment epithelium between retina and choroid lies at the root of this disease, of which early retinal detachment with a rise in tension is an important diagnostic sign. This pathological secretory activity of the retinal epithelium does not depend on any single cause; it may be associated with diseases of the choroid and retina or with toxins present in the circulation.

In conclusion, it is stated, the subretinal fluid in exudative retinitis is mainly, perhaps exclusively, secreted by the retinal epithelium in the same way as in renal retinitis, as set forth in a previous article by the same writer (reviewed in this Journal, Vol. XVIII, p. 705).

THOS. SNOWBALL.

(3) **Barrada, M. A. (Egypt). — Filaria at the macula.** *Bull. Ophthal. Soc. of Egypt*, Vol. XXVII, p. 63, 1934.

(3) **Barrada** reports a most exciting case in which he and other observers saw a nematode worm lashing about in the region of the macula. The patient was 15 years of age. He had suffered from an attack of fever two years previously, and had had two

courses of treatment for bilharziasis. About six weeks before he came under observation he had noticed some deterioration of the sight of his left eye, which on examination was found to be reduced to 3/60, while the visual acuity of the other was normal. The ophthalmoscopic examination of the affected eye showed that at the centre of the macula there was a brick-red circular hole, about 1/3 disc diameter, with a well defined edge. This was surrounded by a grey zone, then by a yellowish zone and finally by a darkish zone with fine dispersed pigmentation. The whole affected area was about 2½ disc diameters in extent. Radiating from the macula were reflexes of folds of the internal limiting layer. Projecting from this hole was a nematode in constant movement, the length of which was about 5 or 6 cm. Medical examination revealed no clinical sign of filarial infection.

The patient was aware of something moving in his eye. About 6 weeks after the first observation of the fundus condition the patient's perception of movement in his eye ceased, and on ophthalmoscopic observation the nematode was no longer seen, and was never seen again.

Observation with the Gullstrand ophthalmoscope enabled the Professor of Parasitology, Dr. Khalil Bey, to pronounce with some assurance that the worm was Onchocerca volvulus. However this kind of filaria has never before been found in Egypt, nor its carrier, simulium damnosum.

A. F. MACCALLAN.

(4) **Bender, M. B. (New York).—Simultaneous closure of all the central retinal vessels.** *Amer. Jl. of Ophthal.*, February, 1935.

(4) **Bender** reports the case of a young married woman who developed a pharyngitis after the extraction of four teeth (which contained a few cavities on the occlusial surfaces) to facilitate the wearing of a denture. The following day she had a headache, diplopia, transient blurring of vision, flashes of red and green colours and a temperature of 101°. Thirty-six hours after the dental extraction she awoke from sleep and found that vision had almost gone. The fundus appearances in both eyes were typical of thrombosis of the central retinal vein. General examination failed to reveal any abnormality in the cardio-vascular and renal systems, the gums at the extraction points appeared to be healthy and the Wassermann reaction and blood culture were negative. There was no evidence of cavernous sinus thrombosis and X-ray examination of the accessory sinuses showed no abnormality.

Subsequently the sites of the branches of the central retinal vessels were represented by a few thin white lines radiating from the optic disc in each eye with a few capillaries derived from the ciliary body entering the periphery of the retina in the right eye.

Pigmentary disturbance and white spots were present at the maculae and newly formed white fibrous tissue was evident on the optic discs. The author in commenting on the aetiology of this condition points out that in such acute inflammatory diseases as influenza and typhoid fever thrombosis may occur, usually secondary to an endophlebitis. He quotes the work of Schwartzman who demonstrated that if the injection of a bacterial filtrate into a rabbit's skin is followed 24 hours later by an intravenous injection of a culture filtrate of the same or another bacterium there appears an extremely severe haemorrhagic necrosis at the prepared sites. To explain this phenomena in the author's case it must be assumed that the retinal vessels of both eyes were damaged locally by some circulating toxin, from the focal infection for example, and that the dental extractions produced a mild bacteraemia which resulted in the haemorrhagic necrosis of the affected retinal vessels.

H. B. STALLARD.

(5) **Greenfield and Nevin (London).—Amaurotic family idiocy.** *Trans. Ophthal. Soc. U.K.*, Vol. LIII, p. 170, 1933.

(5) **Greenfield and Nevin** have recorded the histological findings in the central nervous system and the retina in a case of cerebro-macular degeneration occurring in a child aged 2 years and 10 months, born of English parents and with no family history of this disease. The typical ophthalmoscopic appearances of a cherry red spot at the macula surrounded by a greyish opaque area were present. Delayed development of speech, inability to walk, incontinence and mental deficiency entered the clinical picture before death.

Macroscopic examination of the brain showed widening of the sulci, firmness and shrinkage of the optic thalamus on the ventricular aspect. The cells of the frontal, central, occipital and temporal areas of the cerebral cortex were swollen, pear-shaped, oval, large and small round, with the nucleus displaced to the side or one pole and rarely central. These cells were devoid of Nissl granules and contained granular lipoid which stained with Scharlach R. The cytoplasm was clear and with the Nissl stain there was a faint purple stain in a reticular pattern.

Some of the pyramidal cells of the hippocampus and the large cells of the claustrum showed lipoid swellings on their dendrites. The nuclei were shrunken and surrounded by an aggregation of Nissl substance. The neurofibrils were displaced to the periphery.

In the basal ganglia the putamen and caudate nucleus cells were not swollen, but were devoid of Nissl substance and showed a clear peri-nuclear protoplasmic zone. Lipoid was present in a few of the larger cells. The large cells of the globus pallidus

showed some residual Nissl substance around the nucleus and the cytoplasm was uniformly filled with yellow-staining lipoid. All the cells of the thalamus were devoid of Nissl substance and contained lipoid with a few lipoid dendritic swellings. The substantia nigra was the least affected part of the central nervous system and retained its Nissl granules.

The motor nuclei of the brain stem and spinal cord were round and swollen containing much lipoid and with the nuclei displaced and surrounded by fine Nissl granules. The cells of the lateral oculo-motor nuclei were less swollen, retained their shape and contained Nissl granules throughout the cell body.

In the pons and medulla the motor cells of the 5th, 6th, 7th, 10th and 12th carnial nerves were large and swollen, showed dendritic lipoid swellings in a few instances and a tendency for the lipoid to extend into the bases of the dendrites.

The Purkinje cells of the cerebellum were irregular in size, shape and spacing, contained much lipoid, showed Nissl granules around the nucleus which was shrunken, and branched lipoid swellings on the dendrites. Neurofibrils were absent in the most degenerated cells. The dentate and roof nuclei also showed evidence of lipoid degeneration.

The posterior root ganglia and sympathetic ganglia showed lipoid degeneration and the Nissl substance throughout the cell or represented as a trace around the nucleus.

Medullated nerve fibres were pale in the pyramidical tracts but well marked in the striae of Gennari. There was a diffuse overgrowth of neuroglia in the occipital lobe, hippocampus, thalamus and mammillary bodies and some increased fibrosis in the corpus striatum.

Sub-pial and sub-ependymal gliosis was present in the hypothalmus and 3rd ventricle. The septa of the lateral columns in the spinal cord was thickened and in the cerebellum there was a proliferation of the vertical fibres of Bergman.

In the retina the ganglion cells were swollen; the nucleus pyknotic, irregular, and displaced to one side or to a pole. There were no Nissl granules and lipoid filled the cells except in a few instances. Vacuoles were present at the poles of the cells. The retina was of normal thickness and there was no oedema and no other change.

It would seem from this careful piece of histological work that cerebro-macular degeneration of the clinical type known as Tay-Sachs' disease is due to an extensive lipoid degeneration of certain groups of cells in the central nervous system or retina affecting particularly the ganglion cells. Disturbances in the Nissl substance is evident in the affected cells.

H. B. STALLARD.

VI.—MISCELLANEOUS

(1) **Opin. (Toulon).—Gumma of the papilla. (Gomme de la papille).** *Arch. d'Ophtal.*, April, 1934.

(1) The essential point about **Opin's** case is that in a woman, aged 36 years, apparently in robust health, with absolutely no diagnostic signs of syphilis, who had a healthy daughter, aged 7 years, and whose husband had nothing to show as an indication of the source of the disease except an inequality of the pupils, an intra-ocular swelling occurred which responded to anti-syphilitic treatment. The appearance of the disc is described as follows:—"The disc was completely covered by a greyish-white mass, circular, with clean-cut edges, convex on the surface, projecting into the vitreous, of the diameter of a disc and a half, with the vessels projecting from its edge looking like the feet of a tortoise on the sides of the carapace." The difference in the appearance of the vessels at the edge of the swelling instead of in the centre, as in the case of swelling of the optic nerve, differentiates the case from an ordinary papilloedema. After a series of intravenous injections of cyanide of mercury the author saw the patient again. In spite of an attack of influenza the visual acuity was 0·9 with a normal field. The retinal vessels were normal, the disc slightly pale. At its upper outer portion the exudate previously mentioned had been replaced by a zone of slate-coloured choroido-retinal atrophy, but the fundus was practically normal otherwise.

ERNEST THOMSON.

(2) **Villani. (Rome).—The behaviour of the ciliary body and iris after superficial diathermy. (Comportamente del corpo cigliare e dell'iride alle diatermocoagulazioni in superficie).** *Boll. d'Ocul.*, October, 1934.

(2) It has been generally held to be unwise to apply diathermy in the immediate neighbourhood of the corneal limbus, for fear of disturbing seriously the metabolism of the eye. **Villani** has practised diathermy on a number of rabbits in this region, with the idea of noting how far the damage extends and to what extent the normal functions of the parts will be interfered with. From the microscopical examination of the eyes and from observation of the animals during the period for which they were kept alive, he concludes that even when perforation follows diathermy, the eye remains in good functional state; he concludes that, if it is found advisable in any case to apply diathermy to the human eye in the ciliary region, this may be done safely with no fear of damaging the function or the vitality of the organ.

HAROLD GRIMSDALE.

(3) **Jessel, Erwin (Berlin).—A contribution to the study of the diagnosis and prognosis of intra-orbital tumours. (Contribution a l'étude du diagnostic et pronostic des tumours intra-orbitaires).** *Arch. d'Ophtal.*, April, 1934.

(3) Jessel's article is an analysis of 18 cases which have been discussed by him in *Zeitschr. f. Augenheilk.*, Vol. LXXXII, 1933, and as this is a different Journal—and in a different language—it will, perhaps, suffice if a quotation is given here to indicate the points which are specially discussed. "My object is to draw attention to certain particulars which have occurred to me in the course of studying these tumours. On the one hand I wish to speak of the special characteristics of the exophthalmos, and on the other of certain lesions of the fundus which I have observed, which up till now do not seem to have received sufficient attention from those who have studied the subject." Those who have read about the cases in the original paper might refer to it when reading this article. It seems a confusing thing to write the original in one journal in German and the sequel in another journal in French.

ERNEST THOMSON.

BOOK NOTICES

The Medical Annual, 1935. Pp. 599, with 63 plates and 141 illustrations in text. Bristol: John Wright and Sons, Ltd. Price, 20/-

This is the 53rd year of this well-known digest of current medical literature. The ophthalmic section is, as in the last few years, from the pen of Sir Stewart Duke-Elder. He has provided articles on recent work on the conjunctiva, notably Thygeson's experiments with regard to the bacterium granulosis and Wille's employment of antigonococcic serum as a local installation in cases of gonorrhoeal conjunctivitis which latter was published in our columns last year. Other interesting items in the ophthalmic section deal with band-shaped keratitis, arsenical poisoning involving the cornea, herpetic keratitis, the use of contact glasses, glaucoma, retinal detachment and squint. Among other conditions may be noted the paragraphs devoted to cataract as a sequence of electrical injury, primary diphtheria of the eye, and the X-ray apparatus for the detection of intra-ocular foreign bodies. These last three subjects are by other authors. A specially interesting feature of the volume is the section by Mr. D. Harcourt Kitchin, Barrister-at-Law on Legal Decisions and Enactments of recent date.

The volume is a great credit to all concerned in its production.

NOTES

Deaths

WE regret to see recorded, in the Journal of the Canadian Medical Association, the death of Dr. G. H. Burnham, of Toronto. George Herbert Burnham graduated at Toronto University in 1878 and had practised in Toronto for fifty years. Before starting practice in Canada he spent some years in post-graduate study in this country and took the M.R.C.S.Eng. and the F.R.C.S.Edin. We believe we are correct in stating that he had held the house-surgeoncy at Moorfields.

Dr. Burnham was an original member of the Ophthalmological Society of the United Kingdom and his death leaves only five surviving original members. In our December number of last year we published a paper by him on his views as to the treatment of primary glaucoma.

As we go to press we learn with deep regret of the death, on June 11, of Professor Jules Gonin, of Lausanne. We hope to publish an obituary notice in our next number.

* * * *

Appointments

DR. GAVIN TENNENT left an endowment for the promotion of ophthalmology in the University of Glasgow. A Professorship has been instituted to which Dr. Arthur J. Ballantyne was appointed on May 24. He already holds the Lectureship in the University.

Mr. H. L. Eason is to be congratulated on his appointment as Vice-Chancellor of the University of London for the current year.

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Honour

SIR JAMES BARRETT, C.B., C.M.G., LL.D., has been appointed President-elect of the British Medical Association for the year 1935-36 in place of Sir Richard Stawell, who died on April 18. He was recommended to the Council on the nomination of the Victorian Branch. We beg to congratulate him on this high honour in the name of British Ophthalmology.

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Société française d'ophtalmologie

Mr. LESLIE PATON has been elected *membre d'honneur* of the Society.

Central London Ophthalmic Hospital. Corneo-plastic Department

IN order to facilitate the development of and research into the plastic Surgery of the Cornea, a Corneo-plastic Department has been established, under the charge of Mr. J. W. Tudor Thomas, M.S., F.R.C.S., at the Central London Ophthalmic Hospital, Judd Street, London, W.C.1.

Patients will be seen in the Out-patient Department of the Hospital on Friday mornings at 10.30, and should bring with them a letter from an Ophthalmic Surgeon.

FUTURE ARRANGEMENTS

1935

July 4, 5 and 6.—Oxford Ophthalmological Congress, at Oxford.

July 29—*August* 2.—Second International Neurological Congress, in London.

October 1.—Midland Ophthalmological Society, at Birmingham Eye Hospital.

December 3.—Midland Ophthalmological Society, at Birmingham Eye Hospital.

CONTEMPORARY OPHTHALMIC LITERATURE

American Journal of Ophthalmology. *May, 1935.*

LAMB. The pathogenesis of some intra-ocular osseous tissue. True metaplasia in the eye.

HAESSLER. A factor in the production of divergence increase with near vision.

HAGEDVAAN. Chalazion—lipogranulomatosis.

GRESSER. Studies of retinopathies.

FOLK and SOSKIN. The fundus oculi in diabetes mellitus.

HILDRETH. The external canthal ligament in surgery of the lower lid.

DONAHUE. Two unusual cases of unilateral exophthalmos, one with optic atrophy.

LEFEVER. Argyll Robertson syndrome occurring with pituitary tumours.

LOG. A preliminary report upon a new instrument for the determination of depth perception.

CORDES and HARRINGTON. Epinephrine bitartrate: uses other than in the treatment of glaucoma.

MERRILL and OAKS. Oculoglandular tularemia.

Annales d'Oculistique. *May, 1935.*

ESPILDORA-LUQUE. Ophthalmoscopy of arterial hypertension. Retinal angioscopy.

SÉDAN. Two cases of suppurative iridocyclitis originating from influenza.

PANNETON. Cyst of the inferior fornix.

MICHAIL. Ocular cysticercus in Roumania.

Archives d'Ophtalmologie. *May, 1935.*

AUDEOUD-NAVILLE. A case of keratitis pustuliforme profunda.
PASCHEFF. The laws of true trachoma.
VEIL, DOLLFUS and DESVIGNES. Pathological anatomy of idiopathic retinal detachment.
ALAERTS. New theory on the vision of relief, the priority of peripheral points of the retina.
CORCELLE. Meningeal reactions of sympathetic ophthalmitis.
MORARD. Arachnodactyly and bilateral ectopia lentis.

Revue d'Optique. *January, 1935.*

ARNULF and SCHLEEVEIS. On a method of study of the central obturators of photographic objectives.

February, 1935.

CHATELAIN. Examination of a parabolic mirror by spherical calibres.
BLET. Research on the Stark effect on the bands of absorption of azotic oxide.

Klinische Monatsblätter für Augenheilkunde. *May, 1935.*

KUNZ and ISENSCHMID. The toxic effect of trichlorethylene on the visual organ.
VELHAGEN. Illustrative cases of calcareous deposits near the chiasma.
——— The question of Neophan glasses.
SZÉKELY. Corneal melanosis as a sequel to anterior synechiae.
HANDMANN. Anatomical contribution to the question of recurrent oculo-motor paresis.
SCHLÄPFER. Vogt's entropion operation.
ORTH. Optic nerve metastasis of carcinoma of the breast.
KIEWE. Telangiectatic granuloma (Pediculatum) of the bulbar conjunctiva. Contribution to the question of botryomycosis of the eye.
NICOLAÏ. The mechanism of accommodation. A new theory.
GOLDFEDER. Illustrative cases and pathogenesis of von Szily's annular cataract.
MOTEGI. Contribution to a species of micro-organism in trachomatous tissue.
PASCHEFF. The laws of trachoma.
BRYN. A case of chronic miliary tuberculosis.
BIOZZI. New slit-lamp condition in the region of the posterior surface of the iris: the circular formation of folds.
FODOR. A case of ring-shaped vitreous detachment behind the lens.
ERDÖS. A case of aphthous conjunctivitis.
WOLFSOHN-JAFFÉ. Nine cases of hereditary glaucoma of adults in three generations.
MENDICEVSKI. Spontaneous iridodialysis after sudden strong dazzling.
VON HORVÁTH. Suture for muscle resection.

Lettura Oftalmologica. *March, 1935.*

MATTIUCCI. Calcium chloride in some ocular injuries.
ROSSI. Permeability of the haemato-ophthalmic barrier in experimental anaphylaxis.

April, 1935.

ROSSI. Ocular tension in guanidine tetanus.
FERLA. Contribution to the histogenesis of intra-ocular melanomata.

Annali di Ottalmologia e Clinica Oculistica. *April, 1935.*

CASTELLI. Endemic ophthalmitis from a beetle.
MARCHESINI. A rare form of intermittent exophthalmos with descending atrophy of the optic nerve. (Clinical contribution to the differential diagnosis and pathogenesis.)

CONTINO. Haemorrhagic lymphangiectasis of the conjunctiva.
PAPAGNO. The poly-vitamin therapy for phlyctenular kerato-conjunctivitis.
RUSSO. The physio-pathology of the sclero-corneal angle with particular regard to the pigmentary theory of glaucoma.

Bollettino d'Oculistica. *April, 1935.*

PUSCARIU and LAZARESCU. Considerations on eczematous kerato-conjunctivitis in Iassy's ophthalmic clinic.
FOCOSI. Contribution to the study of endotheliomata of the bulbar conjunctiva.
PANICO. Biomicroscopical aspect of the normal and pathological epithelial tissues of the conjunctiva.
ANELLI. Nictitation in animal series.
BORSELLINO. A case of simple subconjunctival lipoma.
MURA. Contribution to the study of the aetiology of senile cataract.
FIORE. Action of urea on the haemato-ophthalmic barrier.
COLOMBA. Behaviour of the colour sense in various affections of the optic nerve.
STRAMPELLI. Ophthalmoscopic examination by polarized light.

Rassegna Italiana d'Ottalmologia. *March-April, 1935.*

FONTANA. Further histological research on glycogen of the retina of some vertebrates in their natural state and in some experimental conditions.
VENCO. Syphilitic gumma of the orbicularis palpebrarum muscle.
BORSELLINO. Familial bilateral microphthalmos associated with congenital macular degeneration.
BARATTA. Contribution to the study of inflammatory orbital pseudo-tumours.
DUC. Ocular symptoms, reflected in some aural lesions.
BALDINO. Correction of trachomatous entropion of the upper lid.
NEUSCHULER. A new irrigator of the conjunctiva.
TIRELLI. Hereditary congenital ptosis of the upper lid.

Archivos de Oftalmologia Hispano-Americanos. *April, 1935.*

BALBUENA. Three cases of septicaemia following pneumococcal conjunctivitis.
ORTIZ. The anaesthetic value in ophthalmology of the percaine formulae of Maxwell Bochner.
MARQUEZ. The practical treatment of ocular tuberculosis.

May, 1935.

PAVIA. Senile cataract.
LEOZ. Fundamental treatment of ocular tuberculosis.
MATA. My experience of the autohaemo-therapy of the anterior chamber in tuberculous iridocyclitis.

Revista Oto-Neuro-Oftalmologica e Radio-Neuro Chirurgica. *March-April, 1935.*

MORSELLI. A case of tumour of the left occipital lobe.
AGNELLO. Chronic polio-encephalitis with total ophthalmoplegia externa.
PUGLISI-DURANTI. Clinical contribution to the knowledge of ophthalmoplegia interna.
AGNELLO. Angiosclerotic ocular lesions.
DE PETRI. Intermittent and pulsating exophthalmos and the treatment.

Revista de Ophthalmologica. *March, 1935.*

CASTRESANA. Medical treatment of simple glaucoma.

Revista Oto-Neuro-Oftalmologica y de Cirurgia Neurologica. *May, 1935.*

VICTORIA and PAVIA. Epilepsy and cystic degeneration of the retina.